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THE PLANT DISEASE REPORTER

Issued By

THE PLANT DISEASE SURVEY

Division of Mycology and Disease Survey

BUREAU OF PLANT INDUSTRY, SOILS, AND AGRICULTURAL ENGINEERING

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The Plant Disease Reporter is issued as a service to plant pathologists throughout the United States. It contains reports, summaries, observations, and comments submitted voluntarily by qualified observers. These reports often are in the form of suggestions, queries, and opinions, frequently purely tentative, offered for consideration or discussion rather than as matters of established fact. In accepting and publishing this material the Division of Mycology and Disease Survey serves merely as an informational clearing house. It does not assume responsibility for the subject matter.

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BACTERIAL FASCIATION DISEASE OF ORNAMENTAL PLANTS IN CALIFORNIA

Kenneth F. Baker

The fasciation disease caused by Corynebacterium fascians (Tilford) Dowson occurs on numerous ornamental plants during most seasons in California. In many crops this disease occurs only on an occasional plant, but it is often a limiting factor in commercial culture of Esther Read Daisy.

This paper presents the results of field observations and greenhouse and laboratory tests over several years. Specimens are in the Herbarium, Division of Plant Pathology, University of California, Los Angeles.

Chrysanthemum maximum Ram. The disease has been reported (7) on Shasta Daisy in England since 1937, causing leafy galls and witches' brooms; the organism was isolated and pathogenicity established on several ornamentals. The disease is also known on Shasta Daisy in Sweden (2, 10), and in Germany (14) it is reported on the Esther Read variety. The disease on Esther Read Daisy, a type of Shasta Daisy, was first observed in southern California during March and October, 1945 in stock produced at Downey, and in commercial plantings at Santa Barbara and La Canada. The plants in these instances were being divided for sale. Because the plants were grown in the irrigation ditches instead of on the ridge between them, the bacteria had spread down the rows to nearly all of the stock. Large, swollen, "cauliflower" masses of interlocking basal shoots developed at and slightly below soil level. Many of the galls developed decay that often spread and killed the plant. Only a few stems developed normally on each plant and these gave rise to only a few flowers. Cut-flower production of this important florist crop was greatly reduced, and the number of root divisions obtained was drastically curtailed. The disease has been seen many times since, and is generally established in southern California. It was observed by R. H. Sciaroni to be destructive in a commercial planting of Esther Read in San Mateo County during March, 1950.

In several of these plantings Marconi Daisy, another derivative from Shasta Daisy, was unaffected when growing among severely diseased Esther Read plants. It is concluded that the Marconi variety has a very high degree of commercial resistance. Similar differences in resistance to fasciation have been noted among varieties of Chrysanthemum morifolium and Dianthus caryophyllus, and species of Schizanthus and Nicotiana (7, 19).

Preliminary tests were conducted[1] during 1945-46 on possible methods of control. Severely diseased Esther Read plants were obtained from a commercial source in December, 1945. Some of these were planted in a cold frame outdoors in untreated sandy loam of pH 6.8. Others were planted in similar soil that had been adjusted to pH 5.0 by addition of sulfur a few months before. Soil of pH 5.0 has been found (16) to be less favorable for crown gall than that of pH 6.8. Esther Read plants apparently will not survive in such acid soil since they not only failed to grow but died during the next several months. Watering with phosphoric acid diluted 1-10, 1-20, or 1-44 likewise severely injured the plants.

An attempt was made to treat root divisions in hot water (125° F. for 30 minutes), but the plants did not survive the treatment. The following chemical treatments of root divisions were either ineffective in eliminating the bacteria or severely injured the plant: mercuric chloride (1-1000); calomel (2 oz. per gal. plus 1 1/2 oz. gum arabic); calcium hypochlorite (prepared by adding 2 oz. chloride of lime per gal.); sodium hypochlorite (about 5 percent available chlorine, diluted 1-20, 1-10, and 1-5); Elgetol (1-100, 1-500). Several of these materials had been tested by Pirone (15) against gall disease of gypsophila.

Tropaeolum majus L. During studies on the Heterosporium disease of nasturtium (1) seed was planted in pasteurized soil in flats and grown under moist conditions for some weeks in a greenhouse. Some of the plants in 1944 developed cauliflower-like growths entirely typical of those illustrated by Lacey (7, Pl. XVII, fig. 2). These resulted from an increased number of basal sprouts, some of which were thick and fleshy. Growths on individual plants sometimes attained a diameter of 3 1/2 inches. Only a few shoots elongated normally and produced flowers; usually these were weak and spindly.

The evidence is clear that the bacteria are seed borne on nasturtium. Because the long peduncles droop and allow the developing seeds to rest on soil that is frequently moist from ditch irrigation, there is ample opportunity for infestation of seed in the field. Of 13 different varieties indexed in the greenhouse from the 1944 crop of one company, 5 had 1 to 3 percent of infested seed, 3 had 4 to 6 percent, and 5 lots were free of infestation. Seed transmission of C.

[1] Tests by F. R. Talkington and W. Q. Buck, University of California, Los Angeles.

fascians has also been demonstrated for sweet pea (17) and Schizanthus (7).

The hot-water treatment developed (1) for eradicating seed infection by Heterosporium tropaeoli Bond was found to also eliminate the fasciation bacteria. This seed treatment is: (a) soak one hour in cool tap water to eliminate the air space between fruit and seed coat; (b) treat in water at 51.7° C. (125° F.) for 30 minutes; (c) cool at once; (d) dry within 12-20 hours. The treatment was used on the 13 seed lots described above, and 1300 seeds were indexed in flats of pasteurized soil. Only a single infested seed was found, and this probably was a contamination. Many seed lots were treated and indexed over a 4-year period, without the appearance of any other infections in treated lots. It is concluded that the treatment effectively eradicates the fasciation bacteria from nasturtium seed. Germination was not seriously affected by the treatment (1).

The results of successive indexing of 8 commercial seed lots over a 3-year period is shown in Table 1. The seed from the 1944 crop was hot-water treated and free of the bacteria when planted in the fields in Santa Barbara County. The seed harvested from these plantings was 0 to 5.5 percent infested, but was not treated before being planted for the 1946 crop. The seed harvested from the 1946 crop was 0 to 9.0 percent infested. This data indicates that the seed may become contaminated when grown on infested land. Because seedsmen do not plant nasturtiums oftener than every third year on a given piece of land, it seems probable that the bacteria survive on the rotation crops during this period. It is obvious that such contaminated seed infests the land in which it is planted.

Table 1. Successive incidence of bacterial fasciation in nasturtium seed lots during a 3-year period.

Variety and Lot	Percentage seeds with bacterial fasciation. Index of seed grown in year indicated[a]		
	1944[b]	1945	1946
1. Semidouble Dwarf Golden Globe	0	3.5	1.1
2. Semidouble Golden Gleam	0	5.5	9.0
3. Semidouble Dwarf Gem	0	--	2.5
4. Semidouble Dwarf Scarlet Globe	0	--	0
5. Dwarf Single Choice Mixed	0	0	2.2
6. Semidouble Scarlet Gleam	0	1.0	6.8
7. Tall Single Choice Mixed	0	0.5	0
8. Semidouble Glorious Gleam Hybrids	0	1.0	1.2

[a]Based on 100 seeds in each lot in 1944 and 1946, 200 seeds in 1945.
[b]Seed lots hot-water treated before indexing and planting in 1945; none treated thereafter.

Careful examination of field plantings during several seasons has not revealed any "cauliflower" growths, even in plantings the seed of which was found to be infested. It is concluded that this thickened type of development occurs on nasturtium only under moist conditions and probably does not occur naturally in California. Lacey (7) reported it as "natural infection" in England, presumably under moist conditions. There is a witches' broom type of development with many slender shoots that produce few flowers, that occurs infrequently in California seed fields. It is possible, but not demonstrated, that this is the normal field symptom on nasturtium under our conditions. Similar witches' brooms have been described on Shasta Daisy, Erysimum asperum (Cheiranthus allioni), and larkspur in England (7).

Bits of the "cauliflower" growth were transferred to a flat of pasteurized soil in which healthy sweet pea seedlings were started. These soon developed typical fasciation as illustrated by Lacey (5, Pl. X, figs. 2, 3) and Tilford (17, fig. 1), whereas the checks remained healthy. This is in line with Lacey's findings (5, 7) that wounding is not necessary for infection and that host specialization is lacking.

Petunia hybrida Vilm. In May, 1945 a commercial seed field of the variety General Dodds in Santa Barbara County had an occasional plant with basal leafy galls of the type illustrated by Tilford (17, fig. 2). This was a planting held over for a second-year seed crop. Similar infection has never been seen in first-year fields. A single petunia plant with a leafy gall at the stem base was observed in June, 1947 in the University greenhouses, West Los Angeles.

The disease has also been reported in England (7, 11) since 1938.

Lathyrus odoratus L. The disease on sweet pea apparently was first described in 1927 by Brown (3), who attributed it to a form of crown gall. Muncie and Patel (12) considered the trouble to be physiological. That the disease was caused by a specific bacterium was demonstrated by Tilford (17) and Lacey (5) about 1934. The characteristic symptoms on sweet pea are illustrated by Lacey (5, Pl. X, figs. 1-3, Pl. XI, fig. 3; 6, Pl. XXXIII, fig. 3), Tilford (17, fig. 1), and Brown (3, Pls. I and II). The disease on sweet pea is known to occur also in England (5, 6), Sweden (2), and Denmark (4).

The disease has not been seen in the field in California, but developed on plants grown in the University greenhouses, West Los Angeles in March, 1945 and February, 1947. Plants grown from seed planted in soil to which nasturtium "cauliflower" galls were added, also developed typical symptoms.

Transmission on sweet pea seed was demonstrated by Tilford (17). Much of the sweet pea of the seed world is produced in extensive fields in coastal California. The plants sprawl over the ground and when mature are cut and stacked for machine threshing. It is to be expected, therefore, that bacteria from the soil would get on the seed after the pod is broken in threshing. Because sweet peas are always rotated with other crops, it is thus possible for the bacteria to increase on other plants that are more frequently irrigated during the warm season, and to get on sweet pea seed without having actually produced noticeable disease on the plants themselves. The fact that sweet peas are largely grown during the cool winter months and receive little irrigation during the warm spring may explain the apparent absence of the disease in the field.

Tilford (17) disinfested sweet pea seeds that were externally contaminated with the bacteria by immersion for 1 minute in alcohol and then for 20 minutes in mercuric chloride 1-1000. Such treatment of sweet pea seed might be desirable where there is danger of introducing the pathogen to clean land.

Dianthus caryophyllus L. A single infected plant was observed in the University greenhouses, West Los Angeles, in February, 1944. The symptoms were similar to those illustrated by Lacey (7, Pl. XVIII, fig. 2) who first observed the disease on carnation in England in 1934. A dense leafy gall 1 1/2 inches in diameter was formed on the aerial stem. The disease has not been seen in commercial plantings.

Chrysanthemum morifolium Ram. A single plant was observed in the University greenhouses, West Los Angeles, in April, 1947 with symptoms similar to those illustrated by Tilford (17, fig. 2) and Lacey (5, Pl. X, fig. 4; 7, Pl. XVIII, fig. 1). Plants gathered in commercial cut-flower fields in 1949 were found to have an excessive number of slender shoots arising below ground. In the same year a number of plants in the University greenhouses developed leafy basal galls.

Chrysanthemum indicum L. was found in Germany in 1937 (13; 14; 7, Pl. XVII, fig. 4) with broadly flattened fasciated stems due to this bacterium. The florists' chrysanthemum sometimes is referred to this species, and it is therefore not clear what plant was involved in the German collection.

Pelargonium hortorum Bailey. Geranium variety Dwarf Red was found in a commercial nursery in West Los Angeles in April, 1945 with small basal leafy galls somewhat similar to those illustrated by Moore (11, fig. 18). Similar galls were produced from inoculations by Tilford (17), and were observed in England (7) and Germany (13, 14) since 1937.

Phlox sp. The variety Painted Lady was collected in a garden in West Los Angeles in April, 1945. Leafy stem galls at the base of the plants caused considerable injury. A similar disease has been reported in England since 1936 (11).

Rhododendron sp. A single azalea plant in the University greenhouses in West Los Angeles in February, 1940 developed an aerial witches' broom composed of somewhat thickened shoots with small leaves. This plant was adjacent to some chrysanthemums with bacterial fasciation. Since there were some mealybugs (Pseudococcus maritimus) in the azalea broom, the cause of this symptom is not certain.

Host Range

The reported plants showing fasciation, with the nature of the evidence of bacterial causation and the principal references, are given below[2]. Because of the probable report of still other

[2] a = observation; b = C. fascians isolated; c = disease produced by inoculation; * = reported occurring naturally in United States.

hosts in obscure regional lists, this compilation can be only reasonably complete.

Liliaceae - Lilium regale ab (7); Asparagus sprengeri *abc (3a, 6, 7, 14)
Iridaceae - Gladiolus sp. ab (6, 7)
Caprifoliaceae - Viburnum opulus a (2, 4)
Caryophyllaceae - Dianthus caryophyllus *abc (5, 6, 7, 11, 18, this paper); Dianthus barbatus ab (7); Gypsophila paniculata c (17)
Compositae - Chrysanthemum indicum ab (7, 13, 14); C. morifolium *abc (5, 7, 11, 17, 19, this paper); C. maximum, Shasta Daisy ab (2, 7, 10, 11, 14); C. maximum, Esther Read Daisy *ac (7, 14, this paper); C. coccineum *a (18); Dahlia sp. ab (7); Aster frikartii ab (7)
Crassulaceae - Crassula sp. ab (7, 11)
Cruciferae - Cardamine trifolia ab (7); Erysimum asperum (Cheiranthus allionii) ab (7); Cheiranthus cheiri (11a); Brassica oleracea var. botrytis (broccoli) ab (11)
Cucurbitaceae - "melon" a (2)
Geraniaceae - Pelargonium hortorum *abc (7, 13, 14, 17, this paper)
Leguminosae - Lathyrus odoratus *abc (4, 5, 6, 9, 11, 17, this paper); Pisum sativum *abc (3, 7, 17); Phaseolus coccineus ab (7); Phaseolus vulgaris bc (7, 8); Vicia faba c (7)
Loganiaceae - Buddleia davidii a (14)
Malvaceae - Althaea rosea ab (7, 11)
Oleaceae - Forsythia suspensa ab (7)
Polemoniaceae - Phlox sp. *a (11, this paper)
Primulaceae - Primula juliae a (7)
Ranunculaceae - Delphinium ajacis ab (7)
Rosaceae - Fragaria sp. abc (5, 7, 8, 11)
Saxifragaceae - Heuchera sanguinea abc (6, 7, 14)
Scrophulariaceae - Verbascum thapsiforme ab (7); V. abietinum a (14)
Solanaceae - Petunia hybrida *abc (7, 11, 17, this paper); Nicotiana tabacum abc (6, 7, 17); N. glutinosa abc (2, 6, 7); Schizanthus retusus abc (5, 6, 7, 11); S. pinnatus abc (7); Lycopersicon esculentum a (11; but cf. 5, 6, 7, 17); Physalis sp. a (11)
Tropaeolaceae - Tropaeolum majus *ab (7, 11, this paper)

The pathogen has a wide host range of 34 genera in 21 families of Monocots and Dicots. However, resistant or immune plants are known: potato (7, 17), tomato (5, 6, 7, 17), China aster (17), Verbena sp. (17), Calendula sp. (17), Gaillardia sp. (17), Antirrhinum majus (17), Zinnia elegans (17), Campanula sp. (17), Tagetes sp. (17), and Marconi Daisy (this paper).

Discussion

Corynebacterium fascians is rather generally distributed in southern California but is usually of minor importance, even under glass or lath. In England, on the other hand, it is reported (7, 11) to be very damaging to outdoor plantings. It is suggested that this minor importance in southern California may result from the semi-arid conditions and low humidity of the area.

The bacteria affect only the meristems of buds (7). The bacteria are on the exterior of the fasciations (7), perhaps producing the effect by bringing about "loss or disturbance of the normal auxin content or of factors such as 'caulocaline' in seedlings" (9). Wounds are unnecessary to initiate the disease (7). It is probable that more or less continuously favorable conditions for bacterial growth and auxin destruction would be required to produce the extremely shortened internodes of leafy galls. Among these conditions would be moisture and favorable temperatures. Tilford (17) and Lacey (5) found that the bacterium grew in culture at 7°-35° C. with the optimum at 25°-28° C., and it is probable that moderately warm conditions favor the disease. The warm season in England is also humid and has frequent rains, whereas California growing areas have little or no rain from April through October.

The disease has been observed producing economic injury in southern California only on Esther Read Daisy, on which it causes leafy galls originating below the soil surface. Besides being extremely susceptible, the plant is grown with abundant ditch or overhead irrigation during the warm season. Since it is a perennial, infections are initiated with the divisions and develop over several years. It is probably only because of these special circumstances that the disease becomes important on this crop in California. In greenhouses and under lath, humidity is higher and the soil more uniformly moist, making possible disease development comparable to that in England (e.g., on nasturtium, chrysanthemum).

Because of the mechanism of pathogenesis of this bacterium, it would be active in California and destroy auxin (9) only during brief periods of moisture. Bud dormancy might be broken under such conditions without suppressing growth of the ensuing shoot. The new axillary buds formed would remain dormant. It is therefore possible that the typical field symptoms of the disease under dry conditions in California may be only a slight increase in number of shoots. It is certain that the bacteria persist in fields and contaminate seed produced there without causing obvious plant symptoms.

It is probable that the disease is more common in California fields than is presently thought. It is a curious fact that sweet pea and nasturtium seed is contaminated in the apparent absence of the disease. This provides an unsuspected means of introducing the pathogen to areas where it may be much more destructive. It is fortunate that the disease is important in this country mostly on greenhouse ornamentals that are generally planted in steamed soil, as the disease is thus kept at an unimportant level.

In the United States the distribution of the disease is imperfectly known, having been recorded only in California, Colorado, Connecticut, District of Columbia, Georgia, Indiana, Iowa, Maryland, Massachusetts, Michigan, Missouri, New Jersey, New York, Ohio, Oklahoma, Pennsylvania, Virginia, and perhaps Florida and Oregon (3, 12, 18). It apparently was first observed in California in 1944.[3] Abroad it was reported from England by 1927 (5), Germany by 1935 (14), Denmark in 1929 (4), and Sweden by 1938 (2, 10). Until more is known of the distribution of this trouble, its ecology must remain speculative.

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[3](The Plant Disease Survey files contain a record of fasciation, cause unknown, on sweetpea in California in 1940, reported from San Luis Obispo County by G. L. Stout.)

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PERSISTENCE OF 2, 4-D IN PLANT TISSUES

J. G. Brown

Two, 4-D was applied to a lawn (1) in Tucson in the late autumn of 1948. The ester form of the weedicide was used in the concentration of 2 tablespoonfuls of the commercial chemical per gallon of water. Application was made by sprinkling can.

Growing in the lawn were mature trees of Melia azedarach L. Shortly after the treatment of the lawn with 2, 4-D the normal autumnal leaf-shedding occurred, not only in these trees but in Melias and other deciduous trees over town. No signs of injury appeared in the foliage of the Melia trees in the weedicide-treated lawn in the short period that elapsed between application of the weedicide to the lawn and leaf-fall.

Figure 1. Tree, Melia azedarach L., showing persistence of effect of 2, 4-D. Weedicide applied to lawn under tree in autumn just prior to leaf-shedding, 1948. Photograph taken June 25, 1949.

The new foliage (Fig. 1) that appeared on the trees in the spring of 1949, months after the 2, 4-D had been applied to the lawn, showed leaves grading down in size from those with normal leaflets to those with only mere vestiges of leaflets. Some leaflets had fringed margins. Chlorosis was marked.

Melia azedarach in Arizona is not subject to any disease even remotely resembling the above-described symptoms. Indeed, the foliage of the tree is here remarkably healthy. Furthermore, to one familiar with effects of 2, 4-D, the symptoms are unmistakable.

That the effects of 2, 4-D persist in the vegetative tissues of Melia azedarach has been denied by Tullis and Davis (2). Their conclusion needs revision, so far as it concerns that species in Arizona.

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DEPARTMENT OF PLANT PATHOLOGY, ARIZONA AGRICULTURAL EXPERIMENT STATION

NOTES ON SOME WOOD-DECAYING FUNGI OF GEORGIA

W. A. Campbell[1], J. H. Miller[2], and G. E. Thompson[2]

Although a number of individuals have collected wood-decaying fungi in Georgia, the records of these collections, for the most part, are buried in widely scattered herbaria and publications. At the present time there does not exist within the State any readily accessible representative collection of wood-decaying fungi. The Department of Plant Pathology of the University of Georgia has the nucleus of such a collection. In order to augment this collection, considerable effort was made to locate wood-decaying species during the fall of 1949. It now seems desirable to present a report on the wood-decaying fungi of Georgia as found in this herbarium as of January 1, 1950, with the intention of making this list the basis for future additions.

Within the past several years observations on the prevalence and occurrence of certain decay fungi in Georgia have been made by personnel of the Division of Forest Pathology and the Department of Plant Pathology of the University of Georgia. Some of this information, as reported here, represents new information about certain species and hosts. Since the writers are familiar with the relative prevalence of certain species, remarks as to their abundance are given wherever sufficient observations have been made to warrant conclusions. These remarks apply mainly to the northern and northeastern parts of the State. The herbarium contains very few collections of wood-decaying fungi from other portions of the State. It is hoped that opportunity to correct this deficiency may be found within the next few years.

Not all of the fungi in the list can be considered wood-decaying in the strict sense, as some are more properly considered wood-inhabiting; however, they have been included to make the list as complete as possible.

A considerable number of fungi were identified, or the identifications were checked, by experts in these groups. Credit is given to Dr. H. S. Jackson of the University of Toronto for the identification of a number of species of the Thelephoraceae and to Dr. J. L. Lowe of New York State College of Forestry and Mr. Ross W. Davidson of the Division of Forest Pathology for identifying certain of the Polyporaceae.

AURICULARIACEAE

Auricularia auricula-judae (L. ex Fr.) Schrt.
On various hardwoods

TREMELLACEAE

Exidia gelatinosa Bull. ex Schrt.
On Betula nigra L., Quercus alba L. Common
E. glandulosa Bull. ex Fr.
On Quercus velutina Lam., Quercus sp. Common
Sebacina calcea (Pers.) Bres.
Paulownia tomentosa (Thunb.) Steud., Robinia pseudoacacia L.
Tremella lutescens Pers. ex Fr.
Castanea pumila (L.) Mill.

DACROMYCETACEAE

Guepinia spathularia Schw. ex Fr.
On Quercus sp.

THELEPHORACEAE

Aleurodiscus roseus (Pers. ex Fr.) v. Höhn. & Litsch.
On Liriodendron tulipifera L., Rhus glabra L.

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(Thelephoraceae continued)

Coniophora arida (Fr.) Karst.
On unidentified hardwood
C. harperi Burt.
On Quercus alba
Corticium arachnoideum Berk.
On unidentified hardwood
C. berkeleyi Cke.
On Pinus echinata Mill.
C. caeruleum Schrad. ex Fr.
On Cornus florida L., Liriodendron tulipifera, Quercus alba, Vitis rotundifolia Michx.
C. coronilla v. Höhn.
On Betula nigra, Pinus strobus L., Quercus nigra L., Salix sp.
C. evolvens Fr.
On Liquidambar styraciflua L.
C. lilacino-fuscum Berk. & Curt.
On Liriodendron tulipifera, Nyssa sylvatica Marsh., Quercus sp.
C. scutellare Berk. & Curt.
On Arundinaria tecta Walt., Azalea canescens Michx., Liriodendron tulipifera, Morus rubra L.
C. stevensii Burt
Malus pumila Mill.
C. tulasnelloideum v. Höhn & Litsch.
On Quercus alba
C. vagum Berk. & Curt.
On rotten wood
Hymenochaete corrugata (Fr.) Lév.
On Alnus rugosa (DuRoi) Spreng., Carpinus caroliniana Walt., Fagus grandifolia Ehrh., Quercus nigra
H. curtisii (Berk.) Morg.
Carpinus caroliniana, Castanea dentata (Marsh.) Borkh., Quercus alba, Q. nigra
H. pinnatifida Burt
On Alnus rugosa, Elaeagnus umbellata Thunb., Pinus taeda L., Prunus serotina Ehrh.
H. tabacina (Sow. ex Fr.) Lév.
On Castanea dentata, Quercus sp.
Peniophora albomarginata (Schw.) Massee
On Albizzia julibrissin (Wild.) Durazz.
P. cinerea (Pers. ex Fr.) Cooke
On various hardwoods. Common
P. duplex Burt
On Pinus taeda
P. gigantea (Fr.) Massee
Pinus echinata
P. incarnata (Pers.) Cooke
On Alnus rugosa, Platanus occidentalis L.
P. longispora (Pat.) Berk. & Curt.
On Liriodendron tulipifera
P. mutata (Pk.) v. Höhn. & Litsch.
On several hardwood species
P. nuda (Fr.) Bres.
On Prunus serotina
P. obscura (Pers.) Bres.
On Ligustrum amurense Carr., Liriodendron tulipifera
P. roumegerii Bres.
On Alnus rugosa, Ligustrum amurense
P. setigera (Fr.) v. Höhn. & Litsch.
On Pinus echinata
P. subalutacea (Karst.) v. Höhn & Litsch.
On Pinus echinata
P. thujae Burt
On Pinus taeda

(Thelephoraceae continued)

P. torrendii Bres.
On Liriodendron tulipifera, Quercus durandii Buckl.
P. violaceo-livida (Sommf.) Bres.
On unidentified hardwood
Stereum albobadium (Schw.) Fr.
On Carpinus caroliniana, Ligustrum amurense, Prunus serotina
S. cinerascens (Schw.) Massee
On Eleagnus umbellata, unidentified hardwood
S. fasciatum Schw. ex Fr.
On various hardwoods. Common
S. frustulatum (Pers. ex Fr.) Fckl.
On Quercus spp. Common
S. fuscum Schrad. ex Quel.
On Liriodendron tulipifera, Quercus spp.
S. gausapatum Fr.
On stumps and wounds in Quercus spp. Common
S. ochraceoflavum (Schw.) Curtis
On Quercus sp.
S. purpureum Pers. ex Fr.
On Quercus sp., Salix nigra
S. rameale (Schw.) Reddick
On Quercus spp. Common
S. subpileatum Berk. & Curt.
On Platanus occidentalis, Quercus rubra, Q. sp. Occasional
S. umbrinum Berk. & Curt.
On Liquidambar styraciflua, Quercus alba
S. versiforme Berk. & Curt.
On Acer rubrum L.

HYDNACEAE

Grandinia alutacea Berk. & Rav.
On Platanus occidentalis
G. brinkmannii (Bres.) Berk. & Curt.
On Liriodendron tulipifera
Hydnum coralloides Scop. ex Fr.
On Quercus rubra L.
H. erinaceus Bull. ex Fr.
On Quercus spp. Common. Especially common in trunk and branch cavities on street and shade trees in Athens, Georgia
H. ochraceum Pers. ex Fr.
On various hardwoods
Irpex cinnamomeus Fr.
On various hardwoods. Common
I. mollis Berk. & Curt.
On Quercus nigra, Q. montana Willd., Q. rubra. Occasional. Often associated with trunk cankers on living trees.
I. paradoxus Schrad. ex Fr.
On Carya sp.
Odontia arguta (Fr.) Quel.
On Pinus taeda
O. bicolor Alb. & Schw. ex Fr.
On Oxydendrum arboreum (L.) DC.
O. fimbriata Fr.
On Liriodendron tulipifera

AGARICACEAE

Flammula sapinea Fr.
On Pinus spp. Common
Lentinus lepideus Fr.
On Pinus spp. Common
Pleurotus ostreatus (Jacq. ex Fr.) Quél.
On various hardwoods. Common
Schizophyllum commune Fr.
On Malus spp., Prunus spp., Common

POLYPORACEAE

Daedalea confragosa Bolt. ex Fr.
On various hardwoods. Common
D. juniperina Murr.
On Juniperus virginiana L. Rare
D. quercina L. ex Fr.
On Quercus spp. Common
D. unicolor Bull. ex. Fr.
On unidentified hardwood
Favolus alveolarius (Bosc. ex Fr.) Quél.
On Quercus nigra
Fistulina hepatica Huds. ex Fr.
On hardwood stump. Rare
Fomes annosus (Fr.) Cooke
On Pinus echinata, Juniperus virginiana. Common near ground line on old pine stumps. The cause of the dying of red cedar in several locations in the Piedmont.
F. connatus (Weinm. ex Fr.) Gill.
On Acer rubrum, Carya tomentosa Nutt. Occasional
F. everhartii (Ell. & Gall.) von Schrenk
On Quercus marilandica Muench., Q. nigra. Occasional
F. fulvus (Scop. ex Fr.) Gill.
On Prunus angustifolia Marsh., P. umbellata Ell. Common. Inconspicuous and rarely collected but common.
F. marmoratus (Berk. & Curt.) Cooke
On Acer, Carya and Quercus spp. Occasional
F. pini (Brot. ex Fr.) Karst.
On Pinus echinata, P. rigida Mill., P. taeda. Fairly common on old trees
F. ribis (Schum. ex Fr.) Gill.
On Sassafras albidum (Nutt.) Nees. Rare
F. rimosus (Berk.) Cooke
On Robinia pseudoacacia. Common
F. robustus Karst.
On Quercus marilandica, Q. borealis Michx. f. Occasional in the mountains
Ganoderma applanatum (Pers. ex Wallr.) Pat.
On Quercus alba, Q. coccinea Muench., Q. montana. Occasional
G. curtisii (Berk.) Murr.
On Quercus spp. Fairly common
G. lobatum (Schw.) Lowe
On Quercus spp. Occasional
G. lucidum (Leyss. ex Fr.) Karst.
On Quercus spp. Common
G. tsugae Murr.
On Tsuga canadensis (L.) Carr. Rare
Lenzites betulina L. ex Fr.
On various hardwoods. Common
L saepiaria Wulf. ex Fr.
On various softwoods. Common
Merulius ambiguus Berk.
On Pinus echinata, P. taeda

(Polyporaceae continued)

M. confluens Schw. ex Fr.
On Alnus rugosa, Ligustrum amurense
M. corium Fr.
On Acer rubrum, Carya ovata, unidentified hardwood
M. ravenelii Berk.
On Pinus taeda
M. incarnatus Schw. ex Fr.
On various hardwoods
M. terrestris (Pk.) Burt
On rotten wood
M. tremellosus Schrad. ex Fr.
On various hardwoods. Common
Polyporus abietinus Dicks. ex Fr.
On Pinus spp. Very common
P. adustus Willd. ex Fr.
On various hardwoods. Common
P. albellus Pk.
On Pinus echinata
P. amorphus Fr.
On Pinus echinata. Occasional
P. amplectans (Murr.) Sacc. & Trott.
On Asimina triloba Dunal. Rare
P. anceps Pk.
On Pinus echinata
P. berkeleyi Fr.
On base of living Quercus stellata Wang. Rare
P. biformis (Klotzsch) Berk.
On Quercus spp. Common
P. brumalis Pers. ex Fr.
On unidentified hardwood
P. caesius Schrad. ex Fr.
On Pinus echinata, Castanea dentata
P. cinnabarinus Jacq. ex Fr.
On various hardwoods. Common
P. compactus Overh.
On Quercus stellata, Q. sp., Robinia pseudoacacia. The first record of its collection in Georgia and the first time it has been collected on black locust.
P. conchifer Schw. ex Fr.
On Ulmus alata Michx., U. americana L. Common
P. cuticularis Bull. ex Fr.
On unidentified hardwood
P. dependens Berk. & Curt.
On Pinus echinata
P. dichrous Fr.
On various hardwoods. Common
P. dryadeus Pers. ex Fr.
On Quercus spp. A common fungus about the bases of large oaks in Athens.
P. dryophilus Berk.
On Quercus stellata. Rare
P. fissilis Berk. & Curt.
On Castanea dentata, Quercus sp. Occasional
P. frondosus Schrank. ex Fr.
On Quercus nigra
P. fumosus Pers. ex Fr.
On Liriodendron tulipifera, Q. montana
P. giganteus Pers. ex Fr.
On Quercus spp. Occasional. Usually develops around cut stumps.
P. gilvus Schw. ex Fr.
On various hardwoods. Very common. One of the most common polypores on oaks and other hardwoods.

(Polyporaceae continued)

P. graveolens (Schw.) Fr.
On Quercus nigra. Occasional

P. hirsutus Wulf. ex Fr.
On various hardwoods. Common

P. hispidus Bull. ex Fr.
On Quercus spp. Common in the oak woodlots of northeastern Georgia. Also noted on street and shade trees in Athens and vicinity.

P. obtusus Berk.
On Quercus rubra. Occasional. Rather common on Quercus marilandica on the Sumter National Forest in South Carolina adjacent to Georgia.

P. palustris Berk. & Curt.
On Pinus caribaea Morel., P. echinata, P. palustris Mill. Common on recently cut stumps of slash and longleaf pine in South Georgia. Rare on pine stumps in the Piedmont.

P. pargamenus Fr.
On various hardwoods. Very common

P. perennis L. ex Fr.
On buried sticks and on ground

P. picipes Fr.
On Castanea dentata

P. resinosus Schrad. ex Fr.
On Betlua sp., Castanea dentata, Quercus alba. Occasional. Collected only in the mountain areas of the State.

P. rhipidium Berk.
On Quercus sp. Rare

P. sanguineus L. ex Fr.
On Pinus sp.

P. schweinitzii Fr.
At base and from roots of Pinus spp. Occasional

P. spraguei Berk. & Curt.
On Quercus sp.

P. squamosus Huds. ex Fr.
On buried wood of unidentified species

P. subnivosa Murr.
On Quercus sp.

P. sulphureus Bull. ex Fr.
On Castanea dentata, Quercus spp., Occasional

P. tulipiferus (Schw. ex Fr.) Overh.
On various hardwoods. Common

P. versicolor L. ex Fr.
On various hardwoods. Very common

P. vinosus Berk.
On Pinus echinata. Occasional

Poria andersonii (Ell. & Ev.) Neuman
On Quercus spp., Carya tomentosa. Common. Although this fungus is common on oaks it is rarely noticed or collected because of its habit of fruiting under a bark and wood layer which it splits from its host. By the time the bark has fallen so that the Poria may be seen it is usually destroyed by insects. The fungus may fruit for several years on the same dead tree by splitting off successive wood layers.

P. borbonica Pat.
On Liquidambar styraciflua. According to Lowe this is the first collection reported from Georgia.

P. cocos (Schw. ex Fr.) Wolf
On Pinus echinata. Found only in the tuckahoe stage attached to pine roots.

P. nigra Berk.
On Quercus alba

P. pereffusa (Murr.) Sacc. & Trott.
On Quercus sp.

P. punctata Fr.
On Liriodendron tulipifera, Quercus nigra, Tsuga canadensis, Melia azedarach

(Polyporaceae continued)

P. spiculosa Campb. & Davidson
On Carya tomentosa, Quercus spp. Judging by the frequency with which trunk cankers and sterile knots have been observed on oaks and hickory this fungus is relatively abundant. The Poria stage is produced only on the down trunks of trees infected while still living and is rarely seen.
P. subacida (Pk.) Sacc.
On Pinus spp. Common
P. undata (Pers.) Bres.
On Quercus sp.
P. vesiculosa Berk. & Curt.
On Pinus echinata
Solenia anomala (Pers.) Fckl.
On unidentified hardwood
S. conferta Burt
On dead log
S. poriaeformis (DC.) Fckl.
On Vitis labrusca L., V. rotundifolia Michx.
Trametes specium Berk.
On Carya tomentosa

THE DIVISION OF FOREST PATHOLOGY, BUREAU OF PLANT INDUSTRY, SOILS, AND AGRICULTURAL ENGINEERING, U.S.D.A. AND THE DEPARTMENT OF PLANT PATHOLOGY, UNIVERSITY OF GEORGIA, ATHENS

SOME SOUTHEASTERN TREE DISEASES - 1948 AND 1949

George H. Hepting and E. Richard Toole

Below is a list of tree disease cases investigated by the Asheville, North Carolina office of the Division of Forest Pathology in 1948 and 1949. Many well-established diseases, the occurrence of which is not at all unexpected, have not been included.

ASH, GREEN (Fraxinus pennsylvanica)
Witches' broom (virus?). North Carolina
BOXWOOD (Buxus sp.)
Leaf blight (Volutella buxi). North Carolina
BUCKEYE (Aesculus sp.)
Septobasidium sp. Virginia
BUTTERNUT (Juglans cinerea)
Canker (Nectria sp.). Virginia
Leaf spot (Gnomonia leptostyla). North Carolina
CHESTNUT, CHINESE (Castanea mollissima)
Chestnut blight (Endothia parasitica). North Carolina
CHINABERRY (Melia azedarach)
Witches' broom (unknown). Florida
CRAPEMYRTLE, COMMON (Lagerstroemia indica)
Mildew (Erysiphe lagerstroemiae). North Carolina
DOGWOOD, FLOWERING (Cornus florida)
Leaf spot (Phyllosticta globifera). North Carolina
ELM, AMERICAN (Ulmus americana)
Leaf spot (Gnomonia ulmea). Tennessee, South Carolina
Phloem necrosis (virus). Tennessee
ELM, WINGED (Ulmus alata)
Powdery mildew (Uncinula macrospora). North Carolina
GOOSEBERRY, PRICKLY (Ribes cynosbati)
Blister rust (Cronartium ribicola). North Carolina
GOOSEBERRY, (Ribes rotundifolium)
Blister rust (Cronartium ribicola). North Carolina, Georgia
HEMLOCK, EASTERN (Tsuga canadensis)
Twig rust (Melampsora farlowii). North Carolina
HICKORY (Carya sp.)
Witches' broom (unknown). North Carolina
LOCUST, BLACK (Robinia pseudoacacia)
Leaf spot (Cylindrosporium solitarium). Virginia
MAPLE, NORWAY (Acer platanoides)
Maple wilt (Verticillium albo-atrum). North Carolina, Virginia
MAPLE, SUGAR (Acer saccharum)
Maple wilt (Verticillium albo-atrum). North Carolina
Sapstreak (Endoconidiophora virescens). North Carolina
MIMOSA OR SILKTREE (Albizzia julibrissin)
Mimosa wilt (Fusarium oxysporum f. perniciosum). New Jersey, Virginia, North Carolina, South Carolina, Georgia
OAK, CHESTNUT (Quercus montana)
Anthracnose (Gnomonia veneta). North Carolina
OAK, LIVE (Quercus virginiana)
Leaf blister (Taphrina coerulescens). North Carolina
OAK, PIN (Quercus palustris)
Canker (Nectria episphaeria). North Carolina
OAK, SCARLET (Quercus coccinea)
Leaf blister (Taphrina coerulescens). North Carolina
OAK, WHITE (Quercus alba)
Leaf blister (Taphrina coerulescens). North Carolina
Anthracnose (Gnomonia veneta). North Carolina
OAK (Quercus sp.)
Leaf blister (Taphrina coerulescens). North Carolina

PAWPAW (Asimina triloba)
Pawpaw blight (unknown). Tennessee
PINE, AUSTRIAN (Pinus nigra)
Brown spot (Scirrhia acicola). Virginia
PINE, EASTERN WHITE (Pinus strobus)
Blight (unknown). Virginia, North Carolina, Tennessee
Needle cast (Bifusella linearis et al). Virginia, North Carolina
Blister rust (Cronartium ribicola). North Carolina
Canker (Scoleconectria scolecospora). North Carolina
Damping-off (Fusarium sp.). North Carolina
Canker (Caliciopsis pinea). North Carolina
Twig blight (Sphaeropsis sp.). North Carolina, Virginia
PINE, LOBLOLLY (Pinus taeda)
Littleleaf (unknown). North Carolina, South Carolina, Alabama
Leaf rust (Coleosporium vernoniae). South Carolina
Leaf rust (Coleosporium solidaginis). North Carolina, South Carolina
Needle cast (Lophodermium sp.?). South Carolina, Virginia
Needle cast (Hypoderma lethale). Georgia, South Carolina
Stem rust (Cronartium fusiforme). South Carolina
PINE, LONGLEAF (Pinus palustris)
Pitch canker (Fusarium lateritium f. pini). Florida, South Carolina
Leaf rust (Coleosporium vernoniae). South Carolina
PINE, PITCH (Pinus rigida)
Pitch canker (Fusarium lateritium f. pini). North Carolina
PINE, RED (Pinus resinosa)
Canker (Botryosphaeria ribis ?). Delaware
PINE, SHORTLEAF (Pinus echinata)
Littleleaf (unknown). Tennessee, Virginia, North Carolina, South Carolina, Georgia, Alabama, Mississippi
Pitch canker (Fusarium lateritium f. pini). North Carolina, South Carolina
Needle rust (Coleosporium solidaginis). South Carolina
PINE, SLASH (Pinus caribaea)
Fusiform rust (Cronartium fusiforme). Georgia, Florida, South Carolina
Pitch canker (Fusarium lateritium f. pini). Georgia, Florida, South Carolina
Needle cast (Hypoderma lethale). Florida, South Carolina
PINE, TABLE-MOUNTAIN (Pinus pungens)
Stem rust (Cronartium cerebrum). North Carolina
PINE, WESTERN WHITE (Pinus monticola)
Blister rust (Cronartium ribicola). North Carolina
PINE, VIRGINIA (Pinus virginiana)
Stem rust (Cronartium cerebrum). North Carolina
Sweetfern rust (Cronartium comptoniae). North Carolina
Pitch canker (Fusarium lateritium f. pini). Virginia, North Carolina, South Carolina, Georgia, Florida
REDBUD, EASTERN (Cercis canadensis)
Canker (Botryosphaeria ribis). North Carolina
REDCEDAR, EASTERN (Juniperus virginiana)
Root rot (Fomes annosus). Virginia, Georgia, Tennessee, North Carolina, South Carolina
Heart rot (Fomes subroseus). Tennessee, South Carolina
Blight (Phomopsis juniperovora). North Carolina
SUMAC, STAGHORN (Rhus typhina)
Sumac wilt (Fusarium oxysporum f. rhois). Virginia, Connecticut
SWEETFERN, (Comptonia asplenifolia)
Rust (Cronartium comptoniae). Virginia
SYCAMORE, AMERICAN (Platanus occidentalis)
Anthracnose (Gnomonia veneta). North Carolina
YELLOW POPLAR (Liriodendron tulipifera)
Canker (Nectria magnoliae). North Carolina
Damping-off (Fusarium sp.). North Carolina
Sapstreak (Endoconidiophora virescens). Tennessee

Diseases most commonly reported in 1948 include hemlock twig rust, mimosa wilt, white pine blight, needle cast of loblolly pine, littleleaf of shortleaf pine, fusiform rust and pitch canker on slash pine, and pitch canker of Virginia pine. The more prevalent diseases in 1949 include mimosa wilt, oak dying, white pine blight, littleleaf of shortleaf pine, redbud canker, root and heart rots of redcedar, and sycamore anthracnose. However, there was a drop in cases of white pine blight from 16 reported cases in 1948 to 3 in 1949, and a great increase in anthracnose of sycamore from 1948 to 1949.

DIVISION OF FOREST PATHOLOGY, ASHEVILLE, NORTH CAROLINA

BOTRYOSPHAERIA STEM CANKER OF ELM[1]

E. S. Luttrell

In the spring of 1944 at Experiment, Georgia, a black, depressed canker appeared near the base of the stem of a three-year-old potted plant of American elm (Ulmus americana L.). The lesion appeared soon after the leaf buds opened and resulted in the death of the upper part of the plant. Pycnidia developed in the canker and in the dead stem above it. In the spring of 1945 ascocarps typical of Botryosphaeria ribis Grossenbacher and Duggar were present in the dead tissue of the infected stem. Similar ascocarps were produced also on elm twigs that had been sterilized, inoculated with a culture of the fungus obtained from the cankered tissue, and overwintered out of doors. Inoculations with conidia produced in cultures derived from ascospores of B. ribis reproduced the disease. Although this disease had not been observed in the field, it may be of potential importance on American elm seedlings in nurseries. The disease is of interest also because of the extremely long incubation period of the causal fungus.

The cankers caused by B. ribis appeared as elongated-oblong, blackened, slightly depressed areas in the bark of infected stems. They enlarged until they became 1 - 4 cm. in length and often fused to cover larger areas. The larger cankers girdled the stem. Pycnidia of the causal fungus developing in the bark formed scattered pimples over the surface of the canker. On the larger stems the older cankers were black to dark brown with a raised tan margin. Some old cankers were brown to tan and the surface was raised and fissured. In one such canker the dead bark split longitudinally to expose the xylem. The portion of the stem above severe cankers died back and became covered with erumpent pycnidial stromata. Uninfected branches below the canker, however, continued growth. Even when basal cankers resulted in a die back of the entire stem, new shoots grew out from buds formed at the soil line, and the plant ultimately recovered.

Pycnidia of B. ribis were produced in the cankers and on the dead stems throughout the year although on overwintered stems in the spring they were largely replaced by the ascocarps of the fungus. The pycnidia were formed in the bark and were erumpent in the apical portions. They were composed of dark brown pseudoparenchymatous cells and were roughly spherical and 163 353 μ in diameter. They were often separate, especially when formed in the young cankers and on the smaller stems; but typically they were grouped on a plectenchymatous stroma. The conidia were abstricted singly from short sterigmata produced from hyaline cells lining the pycnidial cavity. They were hyaline, nonseptate, fusiform, rounded at the ends, and measured 22.4 - 30.8 x 4.2 - 7.6 μ (Av. 25 = 25.93 x 6.02 μ).

During late winter and early spring stromata containing microconidial locules and the initials of ascigerous locules developed in the dead stems. These stromata were similar to those on which pycnidia were produced. In fact, pycnidia, microconidial locules, and young ascigerous locules have been found grouped together on a single stroma. Once, both conidia and microconidia were found within a single locule. The stromata were often simple, spherical structures containing a single locule. Usually they were compound, containing numerous locules in dome-shaped lobes from the surface of the basal stroma. When sterilized elm twigs in large 12-inch culture tubes were inoculated with the fungus and then removed from the tubes and overwintered out of doors, the ascocarps that developed on the lower part of the stem where the mycelium was best developed in the culture tube were compound; those on the upper part of the stem where the mycelium was sparse were simple. The mature ascigerous locules were spherical and 245 - 286 μ in diameter. The locule was filled with a mass of filiform pseudoparaphyses. The thick-walled, cylindrical, eight-spored asci formed a layer lining the base and sides of the locule and growing upward among the pseudoparaphyses. The ascospores were hyaline, nonseptate, oblong to fusiform, rounded at the ends, and measured 19.6 - 28.0 x 8.4 - 11.8 μ (Av. 50 = 23.97 x 10.22 μ). They were forcibly discharged through an ostiole at the apex of the locule.

The fungus was isolated from surface sterilized tissue from the margin of the original canker, and from ascospores discharged onto agar. Cultures from both sources were similar, the fungus producing a fluffy gray to black mycelium on three percent malt agar. All isolates produced pycnidia when grown on sterilized elm twigs. A single isolate from ascospores produced conidia abundantly on the agar medium.

On June 22, 1945, inoculations were made on a lot of three-month-old American elm seedlings grown from seed in six-inch pots. The seedlings were divided into three groups (Table 1).

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Table 1. Results of inoculations with Botryosphaeria ribis on American elm seedlings.

Treatment June 22, 1945	Number of plants	Results			
		October 30, 1945		April 25, 1946	
		Number infected	Number killed	Number infected	Number killed
Non-wounded					
Inoculated (conidia)	6	0	0	6	1
Control	4	0	0	0	0
Defoliated					
Inoculated (conidia)	5	5	0	5	4
Control	3	0	0	0	0
Wounded					
Inoculated (conidia)	8	6	5	8	6
Control	4	0	0	0	0
Inoculated (mycelium)	3	0	0	3	0
Control	2	0	0	0	0

In group 1, the plants were not wounded. The plants in group 2 were defoliated, all mature leaves being stripped from each plant. The plants in group 3 were wounded by making numerous slits in the bark with a razor blade. Some of the plants in each group were retained as controls. Others were inoculated by means of a pipette with a suspension of conidia produced in culture by an isolate of B. ribis obtained by ascospores. A few of the seedlings in group 3 were inoculated by inserting small blocks of mycelium cut from a petri dish culture of the fungus on malt agar into the wounds. Blocks of sterile agar were placed in wounds on the associated control plants. The seedlings were placed in an inoculation chamber for 48 hours and then returned to benches in the greenhouse.

No evidence of infection was found on these plants until late in October when cankers appeared on some of the inoculated plants and a few of these plants died back. In April of the following year, as growth was resumed, cankers appeared on the inoculated plants that had shown no symptoms the previous fall, and the plants that had shown symptoms previously became more severely diseased. A year after the inoculations were made, all of the inoculated plants were infected although only 50 percent of these plants died back. None of the control plants became infected. It should be noted that the incubation period in these tests was not less than four months, and in many plants it was as much as 10 months. Infections resulting from inoculations with conidia were more severe than those from inoculations with mycelium. Although infection was more rapid when the plants were wounded, the fungus was able to establish itself in stems that showed no apparent wounds at the time they were inoculated.

GEORGIA EXPERIMENT STATION, EXPERIMENT

ERYSIPHE CICHORACEARUM DC. AS A PARASITE OF POTATOES

J. D. Menzies

Although powdery mildews have been reported on potatoes (Solanum tuberosum L.) many times in Europe (1, 2, 5, 6, 7, 8, 12, 15) and twice in North America (4, 14), the identification of the causal fungus has been uncertain because of the absence of the perithecial stage which has not yet been found in Europe. Vanha (15) in 1903 named a potato mildew Erysiphe solani, a name that was tentatively adopted by several authors (3, 6, 10, 12) in spite of the fact that Vanha apparently never published a description of the fungus and it is doubtful if he ever collected mature perithecia. Marchal and Foëx (5) under similar circumstances identified a potato powdery mildew in France as E. cichoracearum DC. Thomas (13) notes that this latter identification has been commonly accepted even although it, too, was based on the Oidium stage only. The two American reports to date have been of mildew on potatoes in experimental greenhouses. In one of these cases Valleau (14) found a few mature perithecia which enabled him to assign that particular mildew definitely to E. cichoracearum.

Since 1946 a mildew, morphologically identical in the perithecial stage with E. cichoracearum, has been commonly observed on potatoes in central Washington. Since this seems to be the first clearly identifiable case of this fungus on potatoes under natural conditions a description of the disease is given.

The mildew is very inconspicuous with sparse mycelial and conidia production. Although observations have been made every year since 1946 no prominent mildewing of leaves has been seen. Usually the infection is confined to the terminal growth of maturing vines and is recognized only by perithecia. The most usual site of infection is on the leaf petiole and along the stem. Perithecia tend to be most numerous in the leaf axils but may occur in a scattered manner on the leaf blades, particularly if they lie close to the ground under humid conditions. On certain varieties a dusty gray appearance of the foliage may result but this is obvious only by comparison with other varieties grown in adjacent rows. This was the case in variety testplots in 1946 and led to microscopic examination and discovery of the mildew on the Mesaba and Warba varieties. Subsequent examination of other varieties, including commercial fields of White Rose and Russet Burbank, revealed a general occurrence of this mildew. Because of this very inconspicuous development of mildew it is quite possible that the fungus has been present without detection for many years.

There seems to be no commercial damage to the potato crop from this parasite. It has never been found on young vigorously growing plants. Appearing late in the season it causes no disease symptom other than a slight superficial russetting of affected tissue.

The fungus produces very few conidia on potatoes. Measurements on mature conidia give an average size of 15 x 30 μ. The abundant perithecia are spherical, black or dark brown, averaging 146 μ in diameter. Asci vary in number from 12 to 16, containing two ascospores each. These characteristics place the fungus in the morphologic species E. cichoracearum DC. as delimited by Salmon (11). Specimens have been examined by J. A. Stevenson, Division of Mycology & Disease Survey, U. S. Department of Agriculture, who concurs in this identification. Specimens have been deposited with the Division of Mycology and Disease Survey, U. S. Department of Agriculture and in the herbarium of the State College of Washington, Pullman, Washington, (W. S. C. P. P. No. 17227).

The same species of mildew occurs locally on a number of native and cultivated plants including Solanum nigrum L. var villosum L. This latter species is commonly found completely covered with a dense, white mycelial growth bearing abundant perithecia. No morphological differences can be seen between mildew collections from this weed and from potato. On numerous occasions, however, severely mildewed plants of S. nigrum villosum have been found intermingled with entirely healthy potato plants in a susceptible stage of growth. This indicates that the potato mildew is a distinct physiologic race.

Judging from the descriptions of the disease as it occurs in various parts of Europe it is still quite possible that a different species or race is involved there. Thomas (13) in England describes a typical conspicuous leaf mildew of discrete or coalescing spots and notes that "in no case were the petioles and stems attacked." Ducomet (2, 3) in France found severe leaf mildewing to the point of partial defoliation. Reports from Germany (6) and Palestine (8), however, describe a sparse, russetting type of mildew similar to the one described here. If these mildews are identical with the one described here, the complete absence of the perithecial stage throughout Europe is strange. It is possible that a weakly pathogenic race of E. cichoracearum has arisen locally on potatoes and is distinct from the potato mildews of Europe.

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DIVISION OF SOIL MANAGEMENT AND IRRIGATION

WILDFIRE DISEASE OF TOBACCO AND SOYBEANS

E. E. Clayton

In 1945 Allington[1] described a wildfire disease of soybeans. He concluded that the causal organism was Pseudomonas tabaci (Wolf & Foster) Stapp, which causes the well known wildfire disease of tobacco. Since then wildfire has been reported on soybeans in many areas where tobacco is not grown. Also in some States, such as Georgia and South Carolina where both tobacco and soybeans are grown, wildfire has been found on soybeans, but not on tobacco. Thus, there does not appear to be any association between the occurrence of the disease on the two crops. To obtain additional information field inoculation experiments were conducted during 1947, 1948, and 1949.

The cultures used were P. tabaci from tobacco as maintained by the writer and P. tabaci from soybeans as supplied each year through the courtesy of D. W. Chamberlain, U. S. Regional Soybean Laboratory, Urbana, Illinois. Plant material consisted of commonly grown flue-cured, broadleaf, and burley varieties of tobacco and the following varieties of soybeans: Gibson, Palmetto, C.N.S., Ralsoy, S-100, Hongkong, Chief, Seminole, Cherokee, Lincoln, Patoka, C101, and Illini. The inoculation procedure was planned to approximate the conditions necessary for severe natural infection with tobacco. Each inoculation was made between 8 AM and 9 AM, following a moist warm night. The organisms were grown in potato-dextrose broth and cultures were diluted about 1 to 50 just before application. Ordinary 3-gallon compressed air sprayers were used to apply the inoculum.

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[1] W. B. Allington, Wildfire disease of soybeans, Phytopathology 35: 857-869. 1945.

Results in 1947: Plantings of tobacco and soybeans were inoculated six times during the period June 15 to September 1. The tobacco organism gave regular heavy infection on tobacco and no infection on soybeans. The soybean organism produced no infection in tobacco. On soybeans a scattering of abortive lesions appeared after the second inoculation. These lesions failed to develop beyond very small dots, and no other infection occurred.

Results in 1948: Five inoculations were made during the period August 3 to September 23. The tobacco organism caused regular heavy infection on tobacco and some individual leaves showed over 2,000 separate lesions. It caused no infection on soybeans. The soybean organism caused no infection on tobacco or soybeans.

Results in 1949: Four sowings were made of soybean varieties at two-week intervals, to provide both young and old leaf tissues for each inoculation test. Eleven separate inoculations were made during the period July 11 to September 24. The tobacco organism caused regular, heavy infection on tobacco, and no infection on soybeans. The soybean organism caused light infection on soybeans from inoculations made on July 18 and August 2. Results from the other nine inoculations were negative. The lesions obtained on soybeans from the two positive inoculations were of the characteristic halo type. There was no secondary spread and damage was negligible. The soybean organism caused no infection on tobacco.

Summarizing the three-years' results: Pseudomonas tabaci isolated from tobacco caused regular heavy infection on field grown tobacco. Results were positive for each of 22 separate inoculations. This organism caused no infection on soybeans. The soybean wildfire organism caused no infection on tobacco and only slight infection on soybeans in 2 out of 22 separate inoculations. These tests were conducted in absence of other leaf spot diseases affecting either tobacco or soybeans.

DIVISION OF TOBACCO, MEDICINAL, AND SPECIAL CROPS

PLANT DISEASES IN WASHINGTON IN 1949

CEREAL DISEASES

WHEAT. Strawbreaker (Cercosporella herpotrichoides) was not important in the State in 1949 because of the severely cold winter and dry summer. Loss was 0.2 percent for the State.

Common Rootrot (Helminthosporium sativum, Fusarium culmorum) also was less than average. Loss for the entire State was 4.5 percent.

Snow Mold. (Typhula spp.). Loss in the Big Bend area was the heaviest on record, about $250,000. Figured on a State-wide crop yield of 115,000,000 bushels, loss from Typhula is a mere 0.8 percent for the State as a whole. The agitation from the few growers who suffer heavy losses, however, necessitates strong consideration of this malady.

Pink Snow Mold (Fusarium nivale). This fungus was widely distributed in Washington in 1949. Loss was 1 percent for the State but was so well distributed as to cause far less excitement than that caused by Typhula.

Rusts were not serious in 1949.

BARLEY. Rootrots were moderate in barley. Common rootrot ran 5 percent loss; strawbreaker in scattered winter barley, a trace. No data was obtained on smuts. Leaf scald (Rhynchosporium secalis) in western Washington showed 7.5 percent loss in yield. Rusts were not serious.

OATS. Rootrot in western Washington was less severe than usual, causing about 4 percent loss. No data is available on smut. Red leaf troubles, including red leather leaf (Pseudodiscosia avenae) averaged 15 percent loss in winter oats in some areas in western Washington.

Crown rust (Puccinia coronata) caused less loss than usual in western Washington.

CORN. No serious diseases were observed. Common corn smut (Ustilago maydis) was reported scatteringly.

FORAGE CROP DISEASES

ALFALFA. No general observations were made. Leaf spots were not uncommon, causing about 2 percent loss for the State (mostly Pseudopeziza spp.). Loss from bacterial blight was 4 percent.

CLOVERS. The virus complex was serious in some pea-growing areas in the Palouse, with

a loss 1.5 percent for the State.

Sclerotinia was common west of Cascades, loss for the State averaging 0.5 percent.

FIELD PEAS. Losses were estimated as follows: virus diseases 2 percent, rootrots 3 percent, powdery mildew 0.5 percent.

GRASSES. Head smut (Ustilago bullata) is sometimes common in mountain brome (Bromus carinatus) and several other grasses including traces in smooth brome (B. inermis). Loss for the State was 0.5 percent. Traces of stinking smut were reported by G. W. Fischer on some grasses.

Seedling blights (Pythium graminicola), seed rots (P. debaryanum, Fusarium spp., Rhizoctonia solani) were common in new seedings, with losses from trace to 70 percent. The average loss from seedling blights and seed rots was 9 percent.

Selenophoma bromigena caused 2.5 percent loss in the State on grasses. Rhynchosporium orthosporum caused 1.5 percent loss on orchard grass; R. secalis 0.8 percent loss on common cultivated grasses, largely in western Washington. Scolecotrichum graminis caused 2 percent loss on timothy, bromes, orchard grass and tall meadow oat grass in western Washington. Eye-spot (Mastigosporium rubricosum) reduced leaf yield of orchard grass and red top 3 percent in western Washington, almost none east of the mountains.

Crown rust (Puccinia coronata) caused trace losses in grasses and leaf rusts (P. rubigo-vera) 1 percent loss. Stem rust (P. graminis) occurred scatteringly. -- Roderick Sprague, (Plant Pathologist, Washington Agricultural Experiment Station, Pullman)

WHEAT SMUT

The survey sampled 47 million bushels representing 35 varieties. This represents 41 percent of the total production for the region. The number of bushels reported grading smutty was 5,480,620, or 11.5 percent of the total reported. On this basis, over 13 million bushels of wheat graded smutty in the Pacific Northwest in 1949.

Prevalence of Smut (Tilletia spp.) in Resistant and Susceptible Varieties of Wheat in the Pacific Northwest in 1949.

Susceptible Varieties	Total Bushels	Number Smutty	Percent Smutty
Golden	6,372,881	1,791,001	28.1
Elgin	10,058,499	2,945,961	29.2
Turkey	8,548,329	152,271	1.7
Requa	1,250,717	52,375	4.1
Federation	3,454,094	66,179	1.9
Jenkin	51,492	16,453	31.9
Baart	1,395,741	14,846	1.0
Idaed	669,289	18,429	2.7
Totals	31,801,042	5,057,515	15.9

Resistant Varieties	Total Bushels	Number Smutty	Percent Smutty
Rex	5,859,770	14,062	0.2
Hymar	3,272,767	71,428	2.1
Orfed	2,215,903	28,571	1.2
Rio	782,855	124,448	15.8
Ridit	437,677	26,449	6.0
Oro	7,022	0	0.0
Marfed	158,155	0	0.0
Wasatch	323,320	0	0.0
Totals	13,057,469	264,958	2.0

Only 14 of the 35 varieties reported were smut-free. These included both spring and winter wheats in relatively small proportions of the total volume. The smut-free winter wheats are all classed as resistant, while the smut-free spring wheats included both resistant and susceptible varieties. Among varieties reported smutty, 16 are classed as susceptible and 5 as resistant. The susceptible winter wheats contributed by far the greatest share of the smutty grain, two varieties, Elgin and Golden contributing 86.4 percent. On a percentage basis, Elgin was slightly higher than Golden in 1949, whereas the reverse was true in the two previous years. Among the resistant varieties only Oro, Marfed and Wasatch were smut-free. Rio had the greatest volume and highest percent of smutty grain. Rex was lowest in percent and volume among the resistant varieties with smut. -- C. S. Holton (Plant Pathologist U. S. Department of Agriculture, Pullman)

BLACK STEM RUST

The abnormally dry season of 1949 inhibited the spread and development of stem rust (Puccinia graminis) on small grain to the point where it was generally difficult to find in fields. Some very late grain in low pockets was infected late in the season. The over-all loss was nil. Barberry bushes in eastern Washington had a light pycnial infection in the spring, much of which did not mature. A number of barberries examined late in the fall in protected timber locations in Eastern Washington had large and numerous aecial scars on the leaves. It is likely that the telial hosts were nearby wild grasses.

VEGETABLE GARDEN DISEASES IN WESTERN WASHINGTON

BEANS. Dry root rot (Fusarium martii phaseoli) resulted in an estimated loss of 35 percent of the Blue Lake bean crop in western Washington in 1949, the majority of this loss occurring in fields that had been planted to beans for three or more years in succession.

The following bean diseases were common but relatively unimportant in western Washington in 1949: rust (Uromyces phaseoli typica), gray mold (Botrytis cinerea), white mold (Sclerotinia sclerotiorum), mosaic (virus), black root (virus?).

OTHER CROPS. Other vegetable diseases which were found to be rather common but doing comparatively little damage in western Washington in 1949 are listed below:

BEETS: Black rot (generally Phoma betae) and internal black spot (boron deficiency)

CELERY: Early blight (Cercospora apii), late blight (Septoria apii)

COLE CROPS: (not for seed production) Club root (Plasmodiophora brassica), downy mildew (Peronospora parasitica)

CUCUMBERS: Angular leaf spot (Bacterium (Pseudomonas) lachrymans), mosaic (virus)

LETTUCE: Drop (Sclerotinia minor), bottom rot (Corticium vagum) (= Pellicularia filamentosa)

ONION: Downy mildew (Peronospora schleideni) (=P. destructor)

PEAS: Foot-rot (Ascochyta pinodella), downy mildew (Peronospora pisi), powdery mildew (Erysiphe polygoni), stem blight (Sclerotinia sclerotiorum), streak and mosaic (viruses)

POTATOES: Late blight (Phytophthora infestans), scab (Actinomyces (Streptomyces) scabies), Rhizoctonia (Corticium vagum) (= Pellicularia filamentosa), ring rot (Corynebacterium sepedonicum), blackleg (Bacillus atrosepticus) (= Erwinia phytopthora), leaf roll and mosaic (viruses)

SPINACH: Downy mildew (Peronospora effusa), root rot (cause unknown)

TOMATOES: Late blight (Phytophthora infestans), leaf mold (Cladosporium fulvum) in greenhouses, leaf spot (Septoria lycopersici), Phoma rot (Phoma destructiva), fern leaf and mosaic (viruses), blossom-end rot (Physiological) . -- Leo Campbell (Assistant Plant Pathologist, Western Washington Experiment Station, Puyallup, Washington)

VEGETABLE DISEASES IN THE WALLA WALLA DISTRICT

Described herein are the plant disease observations made by the writer in the spring and fall of 1949 in the Walla Walla area of Washington.

SPINACH. Downy Mildew (Peronospora farinosa) has become progressively worse in the last few years in this area. In the spring crop only a few widely separated plants were found infected. Weather conditions were not favorable for the development of this disease. In the fall

plantings the disease was present, intensity varying from a few infected plants per field to complete infection of a whole field in one case. For the period of September 5 to September 15, weather was ideal for the development and spread of the pathogen. In fields that were already infected, this was the period in which the greatest loss was incurred. In another report (Wright and Yerkes, PDR 34 (1). 28. 1950) there is an observation of the possible source of inoculum for this disease.

Spinach Rust (Puccinia aristidae) was noted in the spring on volunteer overwintered plants in one location, and was severe. This was the only observation of this disease. The alternate host was not observed.

LETTUCE. Crown rot (Botrytis sp.) was quite widespread and severe in the spring on seedlings imported from other areas. The first indication of infection was a discoloration of the crown just below the lowest leaf. It developed and spread until the whole crown was a slimy, black-brown mass. The tops were usually dead within a week or ten days after the onset of the disease. Fields in which only imported seedlings were used were infected up to 70 percent. Seedlings raised locally were not affected.

CABBAGE. Herbicide injury: In one field of cabbage there was considerable damage done to plants adjacent to a field that had been sprayed with 2, 4-D. The cabbage plants developed necrotic lesions on the outer leaves, resulting in a high percentage of cull plants. This would indicate that greater care should be used in the spraying of fields with herbicides that are adjacent to crops susceptible to herbicide injury.

ONIONS, CARROTS. No diseases were observed on these crops. -- William D. Yerkes, Jr. (Graduate Assistant in Plant Pathology, Washington State College, Pullman, Washington)

POTATO DISEASES

Late blight (Phytophthora infestans) was almost nonexistent in the State in 1949. Fungicidal tests for its control were a failure owing to absence of the pathogen.

Early blight (Alternaria solani) and Stemphylium blight caused considerable damage to certain fields; especially in the Kittitas Valley.

Common scab continued to be a problem in the Moses Lake area in 1949, especially on the White Rose Variety.

Ring rot was observed in a very few fields, most of which were planted with seed from outside the State.

Net necrosis is a problem in the late crop of Netted Gems in spite of the fact that most of the seed planted was unsually free from leafroll. It is especially severe in the Kittitas Valley.

Calico (virus) appeared again in a number of fields. In some cases, the disease was transmitted through the seed while in other cases the plants apparently became infected from neighboring alfalfa plants. -- Avery E. Rich (Junior Plant Pathologist, Washington Agricultural Experiment Station, Pullman, Washington)

Leafroll spread, as indicated by experimental plantings at Prosser, in central Washington, with abundant inoculum available, was greater during 1949 than it has been in any year since 1945. The spread in the very susceptible variety, Netted Gem, was 100 percent. -- S. B. Locke, (Associate Plant Pathologist, Washington Agricultural Experiment Station, Pullman, Washington)

SMALL FRUIT DISEASES IN WESTERN WASHINGTON

RASPBERRIES. Wet Feet. A serious problem in the culture of the Washington red raspberry is a condition locally referred to as "wet feet". In this condition an excessive amount of moisture in the soil tends to suffocate the roots with devastating effects. This generally occurs in heavy soils or with poorly drained soils of a lighter texture but where the water table reaches the roots. It is not unusual to find the plants dead or in poor vigor in a low part of such a planting.

Mosaic. For several years after its introduction in 1937, the Washington variety escaped virus infection because aphids (Amphorophora rubi) did not feed on it. The picture has changed somewhat in the last two years as these vectors are now feeding on the plants. Virus symptoms resembling mosaic and ring-spot have been found in a few fields, but fortunately only a trace is present.

Western Yellow Rust (Phragmidium rubi-idaei) was not of any great economic importance.

This was an exceedingly dry growing season; in addition, control with spray applications was universally practiced, which contributed to the low incidence of the disease.

Anthracnose (Elsinoë veneta) is becoming more of a problem than in former years in those fields where the rust spray was not applied. Anthracnose is present from a trace to about 5 percent cane infections in the sprayed plantings.

Spur Blight (Didymella applanata) is present in most fields; however, thus far no serious effects upon growth or yield have been detected.

Winter injury was responsible for severe losses in certain raspberry growing sections, particularly near the Canadian border where at least 50 percent or more of the plants were seriously injured. The losses sustained were not only in the killing of the current season's fruiting laterals, but also in reduced cane growth for this year's crop. This is the first time the Washington variety was thus affected in western Washington.

BLACKBERRIES. Cane blight (Septoria sp.), which in previous years has caused losses in yield varying between 20 to 90 percent, was adequately held in check by the spray program.

Cane and Leaf Rust (Kuehneola uredinis), which was so universally present in the Evergreen blackberries in 1948, was scarcely found and was of no economic importance in 1949. The dry weather is believed responsible for this effect.

Crown Gall (Phytomonas (Agrobacterium) rubi) is in some years present in serious proportions depending to some extent upon climatic factors, but this year only a trace was found. This was also true among the so-called trailing-blackberry group of varieties, such as Logan, Young and Boysen. -- Folke Johnson (Associate Plant Pathologist, Western Washington Experiment Station, Puyallup, Washington)

STRAWBERRIES. Yellows (virus) reduced the total yield of strawberries in western Washington about 35 percent in 1949; and 25 to 50 percent more acreage would have been planted from 1947 to 1949 had not the growers feared yellows.

Red Stele (Phytophthora fragariae). Where strawberries were planted in red stele soil, losses amounted to from 25 to 75 percent, but a comparatively small acreage is being grown on such soils as growers have learned to avoid these areas for strawberries.

The strawberry diseases common but relatively unimportant in western Washington in 1949: Leaf spot (Mycosphaerella fragariae), leaf scorch (Diplocarpon earliana), leaf blight (Dendrophoma obcurans), powdery mildew (Sphaerotheca humuli), root rots (various fungi), gray mold (Botrytis sp.) leaf and stem gall (Anguillulina dipsaci), crinkle (virus), dud (Physiological). -- Leo Campbell, (Assistant Plant Pathologist, Western Washington Experiment Station, Puyallup, Washington)

DISEASES OF CRANBERRIES AND BLUEBERRIES

A disease survey of the commercial plantings of cranberries and blueberries in the coastal area of the State was made during the summer of 1949. A few of the more important observations are included in this report.

CRANBERRIES. Field diseases of cranberries were few. In young plantings, especially where fertilization was heavy, abundant lesions of red leaf spot (Exobasidium vaccinii) were noted on young stems and leaves of the cranberry in the Long Beach, Grayland, and Grays Harbor areas. Rose bloom (Exobasidium oxycocci) was seen rarely in the Long Beach area.

Cotton ball (Sclerotinia oxycocci), black rot (Ceuthospora lunata), and various other fungus fruit rots were observed in harvested barries from the Long Beach area.

BLUEBERRIES. A Botrytis twig-blight (Botrytis sp.) was quite severe in the Long Beach area on young plants of Vaccinium australe. Young twigs of the blueberry plants became infected near their tips. The Botrytis developed within the tissues of the stem for a distance of several centimeters. Some stems were destroyed for a distance of five decimeters in cases where infection had been established the previous season. In addition to the twig-blight, Botrytis was also associated with an extensive leaf spotting and fruit rotting. From 10 to 15 percent of the blueberries grown at the Cranberry-Blueberry Experiment Station, Long Beach, Washington were infected with Botrytis. In most instances the twig-blight stage of the disease was not severe on the older, slower growing plants.

Botrytis severely attacked the fruit of the native Vaccinium ovatum in some parts of the Long Beach area. The twig-blight was observed on the native blueberries -- V. ovatum and V. parvifolium. It was produced by inoculation with cultures of Botrytis on V. pennsylvanicum, V. ashei, and V. occidentale in the experimental plots.

Leaf rust (Pucciniastrum myrtilli) was found on a single leaf of a hybrid of V. pennsylvanicum x V. australe in the experimental plots at the experiment station at Long Beach in July.

This rust was not found on any other specimen of V. pennsylvanicum or V. australe during the remainder of the summer. In August the leaves of V. deliciosum in the same plots were rather heavily infected with leaf rust. Tsuga heterophylla growing in the area immediately contiguous to the experimental plots was free of any aecial form of any rust when it was examined critically. The leaves of an experimental planting of rabbit-eye blueberry hybrids, V. ashei, near the experiment station were abundantly infected with leaf rust in August. V. parvifolium, a wild species, was infected with leaf rust in the vicinity of Bellingham, Washington in August.

Stem rust (Pucciniastrum goeppertianum) occurred on V. ovatum, the most abundant native species of blueberry in the Long Beach area. It was not observed on any of the commercial species or varieties.

Exobasidium vaccinii occurred as a leaf spot on V. uliginosum plants which had been transplanted from the coast of southern Oregon to the experimental plots at Long Beach. -- Austin C. Goheen (Graduate Assistant in Plant Pathology, Washington Agricultural Experiment Station, Pullman, Washington)

TREE FRUIT DISEASES IN WESTERN WASHINGTON

APPLES. The apple industry, except for a few instances, is not commercially important but consists mainly of home orchards. For this reason no particular observations on the disease situation of the different varieties have been noted. It will suffice to say that scab (Venturia inaequalis), Northwestern apple-tree anthracnose (Neofabraea malicorticis) and powdery mildew (Podosphaera leucotricha) are present in varying amounts each year depending upon the varieties and climatic factors.

PEARS. There was a light crop of Bartletts, and scab (Venturia pirina) was severe where an adequate control program was not practiced. In one small commercial orchard up to 50 percent or more scabby fruit was estimated. Where sprays were properly timed and applied good control was obtained.

Blossom blast and twig die-back (cause undetermined) is a major problem in Bartlett and Anjou orchards in the southwestern part of the State. The severity of the disease fluctuates from year to year; in some instances all the flowers die with obvious loss of crop. Except in a few orchards the percentage of trees thus infected is not large.

PEACHES. Leaf curl (Exoascus (Taphrina) deformans) is serious in unsprayed orchards, nearly 100 percent infection of the leaves occurring each year. In such cases fruit infections are not uncommon. Trees left unsprayed for two years in succession usually result in complete death. If rains are common during the growing season, leaf infections may be noted from early spring until leaf fall.

Brown rot (Sclerotinia (Monilinia) fructicola and S. (M.) laxa) is a serious problem, from the standpoint of blossom and fruit infections as well as twig cankers. Active sporodochia have been found on blighted twigs and mummies hanging on trees from midwinter to spring. In wet seasons up to 60 percent loss in fruit was not uncommon, but during the dry 1949 growing period the disease was held in check and less than 10 percent loss was estimated. Decay of harvested fruit in peach containers either in the orchards or in stores is a difficult problem to contend with.

Peach blight (Coryneum beijerinckii) is more important in the southern part of the State than to the north. The disease was not prevalent to any great extent this year.

SOUR CHERRIES. Ring-spot and yellows (virus) were present in all commercial orchards visited. Indeed it is difficult to find a normal helathy tree free from these symptoms. Leaf cast caused by the yellows virus in some years reaches as high as 40 to 50 percent. This phase of the problem was not so acute as in the previous year.

Pink fruit (virus), which is a condition causing the fruit to be unsaleable, is rarely found. Less than 1 percent of the trees are infected. While it does not spread rapidly in an orchard, it is a hazard because the pickers do not discriminate against the culls and mix this fruit with the healthy, causing confusion and some loss to the grower as such lots must be discarded in the cannery. The unharvested fruit allowed to remain on the infected trees soon becomes infected with brown rot and thus enhances the development of this more serious problem.

Brown rot (Sclerotinia (Monilinia) fructicola and S. (M.) laxa) is a constant threat to production. Blossom and spur blight cause losses even in unfavorable years up to 25 percent. This high incidence of infection is held in check by the more progressive orchardists.

Leaf spot (Coccomyces hiemalis) was so prevalent in 1948 that total leaf cast was present in some unsprayed orchards by mid-August. In the same orchards without control practices one could scarcely find a single leaf spot in 1949. -- Folke Johnson (Assoc. Plant Pathologist, Western Washington Experiment Station, Puyallup, Washington)

TREE FRUIT DISEASES IN EASTERN WASHINGTON

The following notes are made of general observations on plant diseases in Washington in 1949:

Coryneum blight of stone fruits (Coryneum beijerinckii) was less than usual and negligible as compared with injury in 1948.

Brown rot (Sclerotinia (Monilinia) fructicola) injury was much less than usual and negligible as compared with 1948.

Peach leaf curl (Taphrina deformans) was minor and much less than in 1948.

Powdery mildew (Podosphaera leucotricha)(apples, peaches, and cherries) was very minor and much less important than in 1948, (an extreme year), and caused less injury than usual.

Fire blight of apple and pear (Erwinia amylovora). Damage was more than usual but minor compared to 1948, which is probably the worst blight year recorded in Washington. In 1948 blight damage was observed on apricot and on Santa Rosa plums.

Cherry leaf spot (Coccomyces hiemalis) was much less important than usual and far less than 1948.

Western X disease of peaches (virus), where no roguing is done, seems to be on the increase. Evidence last winter, 1948-49, indicates severe damage and killing of X-infected trees in some areas.

Little Cherry (virus). In areas where the disease is prevalent, increase was considerable. Where tree removal is practiced in lightly infected areas, spread seems to be definitely retarded.

Twist leaf of cherry (virus) is on the increase.

Ring pox of apricot (virus). A great increase over normal was noted for cases of this disease.

Prune leaf spot (Probably genetic with close relation to environmental changes) was noted more often and in more serious proportions than usual.

Winter injury to peach, apple, prune, apricot, and cherry was severe in certain sections of the State, particularly in the Okanogan, Wenatchee, and Moses Lake areas. Both young and old trees were affected.

Phytophthora rot (Phytophthora cactorum), on apricot and pears, was much less than in 1948 and probably less than normal. In one apricot orchard near Yakima there was no tree or fruit injury where the disease was very serious in 1948.

General: The dry Spring, Summer and Fall months probably had more to do with reducing damage from parasitic diseases than did control measures. This is particularly true of fire blight.

In general summary, the fruit disease situation in Eastern Washington was very favorable in 1949. -- Earle C. Blodgett (Assoc. Plant Pathologist, Washington Agricultural Experiment Station and Washington State Department of Agriculture, Irrigation Experiment Station, Prosser, Washington)

VARIOUS TREE FRUIT DISEASES

Apple Powdery Mildew (Podosphaera leucotricha). A survey of over 200 orchards in the north-central part of Washington showed the following percentages of twig infection by varieties: Jonathan (49 orchards) 21.3%, Golden Delicious (17 orchards) 5.1%, Romes (17 orchards) 2.8%, Delicious (78 orchards) 0.5%, Winesap (41 orchards) 0.2%.

Apple mildew was less serious than in 1948, partly because of severe winter killing especially in the susceptible variety Rome, which actually had much of the mildew inoculum killed out by terminal death through low winter temperatures.

Pear powdery mildew (P. leucotricha) was scarce in north-central Washington but scattered twig infection was found near Peshastin.

Peach powdery mildew (Sphaerotheca pannosa) was serious in a few thickly planted orchards in eastern Washington, and a trace of fruit cullage was noted for the State.

Cherry powdery mildew. Scattered infection by undetermined powdery mildews was noted on cherry leaves, especially after harvest. Most of the infection was conidial only. Some fruit molding occurred. Loss in the State was not over 0.1 percent, in a few orchards it was as high as up to 5 percent.

Fire blight (Erwinia amylovora). Pears, and less often apples, continued to suffer from blight, especially where the malady was permitted to run during the summer unchecked. Loss in pears was 2 percent; in apples only a trace.

Phytophthora rot (Phytophthora cactorum, in part). A firm rot of pears, apricots, and peaches was noted in a number of orchards. In the Peshastin area Bartlett pears showed economic loss, especially in orchards using overflow water from infected orchards further up the slope. Loss for the State was 0.1 percent.

Cytospora Bark Rot. The conspicuous long amber yellow horns of pycnospores of Cytospora sp. are very common on weakened trees of apples, cherries, and sometimes other fruits. Sometimes the horns are called moss by growers. It is doubted whether this fungus, or fungi, is parasitic, but it has caused concern.

Perennial Canker (Gloeosporium perennans). Perennial canker has not been important in central Washington, but the erratic ability of some of the newer insecticides to control wooly aphids -- its co-habitant -- has caused some increase in cankers. -- Roderick Sprague (Plant Pathologist, Washington Agricultural Experiment Station, Pullman, Washington)

DISEASES OF ORNAMENTALS

CHRYSANTHEMUM. Stunt (virus) was present in several greenhouses but was of less importance than in 1948.

CYPRESS (Chamaecyparis). Root rot (Phytophthora lateralis Tuck & Milb.) was of moderate importance in three widely separated nurseries.

GLADIOLUS. Botrytis leaf and flower blight (Botrytis sp.). General, but of much less importance than usual, apparently because of a drier growing season. Serious early in the season only in one field which had poor air drainage.

Curvularia leaf spot (C. lunata (W) Boed.). Apparently not yet present. (Based upon a survey of several large gladiolus fields in various parts of western Washington.)

Mild mosaic (virus). General, apparently present in all commercial stocks, but usually unimportant.

White break (virus). General, but serious only in a very few stocks and varieties such as Picardy. The growers are roguing such stocks intensively.

Botrytis corm rot (Botrytis sp.). General but of less importance than usual.

Dry rot (Stromatinia gladioli (Dray.) Whet.) General and serious in many stocks. This is the worst corm disease present in western Washington.

Fusarium corm rot (Fusarium spp.). Present in a few stocks, especially those "imported" recently from warmer states. This disease tends to become eliminated from stocks after being grown for two or more years in western Washington, apparently as a result of the cool climate.

Penicillium corm rot (Penicillium gladioli Mc. & Thom. ?). Occasional.

Scab (Pseudomonas marginata (McCul.) Stapp). General and more serious than usual, especially in some stocks grown on light, sandy soils. Probably favored by the unusually warm temperatures during the growing season of 1949.

Leaf scorch (caused by fluorine fumes). Present on a few stocks grown near aluminum factories.

HYACINTHS. Yellows (Xanthomonas hyacinthi (Wakk.) Dow.). Of moderate importance in two field stocks, including varieties L'Innocence and Pink Pearl. Also found in greenhouses on imported bulbs.

Mosaic (virus). General.

IRIS. (Bulbous). Mosaic (Iris Virus I K.M.Sm). General. Serious in some stocks.

Nematode (bulb or stem nematode). General and serious in some stocks. Being brought under control with a three-hour hot water-formalin treatment of planting stocks.

Crown rot (Sclerotium delphinii Welch.). Widespread and minor, but somewhat more prevalent in 1949 than 1948, apparently stimulated by the unusually warm spring.

Fire (Didymellina macrospora Kleb.). General, but minor in most stocks.

Fusarium basal rot (Fusarium sp.). Minor and localized. Severe in one stock of DeWit which was subsequently discarded. Only occasionally found in the main variety, Wedgewood.

Blue mold (Penicillium sp.). General but minor. Usually serious only in stocks that are bruised or kept under poor storage conditions.

LILIUM LONGIFLORUM (Easter Lily) (This report is based primarily upon a survey made by Mr. Roy C. McCue, Horticultural Inspector, Washington State Department of Agriculture, Vancouver, Washington)

Dieback or bunchy top (Aphelenchoides olesistus Ritz. Bos.). General, ranging from 0 to 11 percent with an average of 0.5 percent. Distributed more widely than in 1948 but over-all infection lower.

Botrytis blight (B. elliptica(Berk.) Cke.). General, ranging from 0 to 90 percent, probably averaging about 5 percent.

Winter injury. More serious than usual, resulting in smaller bulbs and lower yields.

Nitrogen deficiency (and perhaps other deficiencies) were evident, especially in fields adjacent to the ocean. Such deficiencies may be confusing the Botrytis situation.

Streak (virus-?). Found in several fields but generally minor.

NARCISSUS. Basal rot (Fusarium oxysporum f. narcissi (C. & M.) (S. & H.). General, but less important than in 1948, possibly because of the cooler growing weather.

Nematode (Ditylenchus dipsaci (K.) Filip). Minor, except in some stocks recently imported.

Leaf diseases (Fire, etc.). Minor. Some smoulder (Sclerotinia narcissicola Greg.) in plantings left undug for two years.

Mosaic (Narcissus-mosaic virus). General, ranging from a trace to 50 percent and averaging 2 percent in the main variety, King Alfred. This disease is becoming of less importance since growers are roguing more intensively.

Decline (Silver streak, etc.) (virus). General and quite serious in some stocks, a few of which have been discarded as a result. Stocks of the common variety, Wedgewood, ranged from a trace of infection to 100 percent with an average of 13 percent. The growers are initiating an intensive roguing program so the situation should improve.

Crown rot (Sclerotium delphinii Welch). Of minor importance in narcissus. Present in two samples from Orting, Washington.

PINE, WHITE. Blister rust (Cronartium ribicola Fischer). Serious in some ornamental plantings in Pierce and King Counties.

ROSES. Powdery mildew (Sphaerotheca pannosa (Wallr.) Lév.). Widespread and destructive where spraying or dusting programs were omitted.

Black spot (Diplocarpon rosae Wolf.). Widespread and occasionally destructive where spraying or dusting programs were omitted.

Blossom blight (Botrytis sp.). Present late in season but of less importance than in 1948.

TULIPS. Botrytis blight (B. tulipae (Lib.) Lind). General but less serious than usual because of the warmer and drier spring weather.

Mosaic (Tulipa Virus 1 and 2 K.M.Sm.). General but minor.

Crown rot (Sclerotium delphinii Welch). Found in one sample of bulbs in Pierce County.

Blue mold (Penicillium spp.). General. Usually minor, but serious in a few bulb stocks that were bruised when digging and/or kept under poor storage conditions.

Fusarium leaf blight (Fusarium sp.). Present on three plants in two stocks. Rare.

-- Charles J. Gould (Assoc. Plant Pathologist, Western Washington Experiment Station, Puyallup, Washington) and George W. Wade (Nursery Inspector, Washington State Department of Agriculture, Sumner, Washington)

2, 4-D INJURY TO SHADE TREES IN THE PALOUSE AREA

Damage to shade trees in the Palouse area, concomitant with widespread aeroplane spraying of wheat fields with 2, 4-D for weed control, was more serious in 1949 than it was in 1948. This probably was the result of a very dry season which limited recovery from the injury and development of new foliage. Box Elder trees were severely damaged, the leaves turning yellow or rusty brown and falling prematurely in late summer. No new growth was put out later in the season as was the case in 1948. Formative effects in young growth of Black Locust, Siberian Elm and Sugar Maple were also observed, but the damage to these trees was not severe. In 1949 the injury was observed in Box Elder in the immediate vicinity of Pullman, as far south as Dayton, west to the Snake River, and north as far as Thornton. -- S. B. Locke (Assoc. Plant Pathologist, Washington Agricultural Experiment Station, Pullman, Washington)

In addition to the plant pathologists named above, assistance in preparing this report was received from H. B. Busdicker, Plant Pathologist U. S. Department of Agriculture, Pullman, Washington.

INFECTIOUS AND NON-INFECTIOUS PIGMENT DISORDERS IN THE SMALL GRAINS, WITH PARTICULAR REFERENCE TO THE SOUTHEASTERN AREA

H. H. McKinney

Introduction

From the beginning of the studies on the virus mosaics of wheat, several pigment disorders have confused the diagnostic work in the field and sometimes in the greenhouse. On this account, it has been necessary to observe, and to make inoculations from plants showing these confusing pigmentations.

Observations and Inoculation Tests

Plastid pigment disturbances. In Illinois, the accentuated green color of mosaic-rosette wheat plants made it necessary to conduct comparative studies in cooperation with the Bureau of Entomology and Plant Quarantine to settle the confusion with the accentuated green wheat plants suffering from Hessian fly infestations. These studies were reported, with colored illustrations, in 1933 (6, plate II).

At Madison, Wisconsin, a yellow spotting on wheat leaves suggesting mosaic was regarded by the experiment station workers as indicating faulty nutrition. Inoculation tests failed to transmit the disorder. The disorder was mentioned and illustrated in 1925 (2, fig. 3).

At Arlington Farm, Virginia, certain wheats and wheat relatives would in certain seasons develop longitudinal light-green to almost yellow bands or streaks, alternating with nearly normal green streaks. When genotypes carrying these streaking factors became infected with mosaic virus, the chlorotic streaking was accentuated or actually brought to expression even though the conditions did not favor streaking in plants growing in non-infested soil. In Polish wheat the green streaks could be almost obliterated when the leaves were infected with mosaic virus. Rarely were the telltale symptoms of virus mosaic absent in the apical portion of the streaked leaves. Virus was recovered from such leaves, but not from streaked leaves growing in soil known to be free from virus. These chlorotic and mosaic patterns were described and illustrated in 1930 (3, figs. 1F, 2B and 2C).

When wheat mosaic was first studied in North Carolina in 1930 and 1931 it became evident that pigment disorders were more prevalent there than in any of the Northern States in which the wheat mosaic studies had been conducted.

Pigment disorders other than mosaics have been in evidence, especially on "marginal" lands, during studies on the wheat and oat mosaics in the South since 1944. It was found necessary to consult with State and Government workers versed in soils and mineral deficiencies, and to follow their literature to some extent, in order to facilitate the diagnosis of the cereal mosaics in the field. Many helpful suggestions have been made by Myron Anderson of this Bureau, by W. H. Rankin of the North Carolina Agricultural Experiment Station, W. R. Paden of the South Carolina Agricultural Experiment Station, and by the workers of the U. S. Soil Conservation Service located at Clemson, South Carolina.

On many occasions oat plants have been observed with their leaves almost solid yellow, and other plants with their leaves streaked with yellow. The field appearance of these yellowed plants is similar to plants with magnesium starvation as illustrated by Hoffer (1), in his plate 13. The streaked leaves resemble the streaked leaves of zinc-deficient corn and magnesium-starved corn, as illustrated in Hoffer's plates 2A and 5A, respectively. The streaked leaves may become progressively more yellow and then progressively more green with the growth of the plants. When the stems elongate, it can be seen that they have a yellowish cast when compared with the stems of normal plants. Sometimes, but not always, the older leaves of these plants become progressively reddened, beginning at the tips.

Red streaking, comparable to the yellow streaking in the upper growing leaves of the plant, has not been observed by the writer in the small grains in the South. However, red senile leaves sometimes show streaking.

The plants with solid yellow leaves and those with yellow streaked leaves occur in the field singly, in a scattered formation among normal plants, or in solid formation in spots that vary in size from a few inches to many feet in diameter. Sometimes there are signs of poor drainage in these spots, but not always. The plants show varying degrees of stunting. Inoculation tests have failed to reveal virus in these plants. Soil in which such plants were growing at Blacksburg, Virginia, in 1949, was supplied the writer by C. W. Roane and B. B. Bayles. Letoria oats was grown in it, and also in soil known to carry the oat-mosaic viruses. Strong mosaic symptoms

appeared in the plants in the latter soil. The plants in the soil from Blacksburg remained free of all signs of chlorosis and reddening, but the leaves were a deeper green color in comparison with healthy Letoria growing in soil from other sources.

A few oat plants with yellow streaked leaves have been observed, and the leaves found to continue alive without tip-burning for surprisingly long periods, showing signs of senility and death very little, if any sooner than normal green leaves. These plants produced seed. The same observation has been made in certain varieties of wheat, Polish wheat and spelt, depending on the soil and the season. Such observations suggest genetic types that are weak in chlorophyll production, but which have strong survival powers even when the environmental factors favor the expression of the chlorotic condition.

On many occasions the writer has examined fields of small grain thought to have a uniform infection of virus mosaic, only to find that the pigment disturbances conformed to those associated with malnutrition and low temperature. It would often be found that the weather had been cold and rainy for several weeks. The spring application of nitrogen may have been made early, and lost by leaching, or wet weather may have prevented its application. In any case, cold temperatures and lack of sunshine do not favor nitrification or an otherwise normal metabolism in cereals that should be in active growth. Sometimes such fields showed signs of direct cold injury to the plastid system.

During the latter part of April 1947, at Statesville, North Carolina, low temperature had killed most of the foliage in the oat-mosaic nursery, and part of the plants of four strains had been killed. Many lines indicated no cold injury, whereas others showed marked chlorosis, in the new leaves, indicating that some of the functions attending the plastids had been disrupted by the low temperature when the leaves were still very small. In March 1949, at Clemson, South Carolina, a similar situation was observed in the barley-mosaic nursery. Selections made during such critical seasons greatly facilitate the emphasis on the more cold resistant lines required in the breeding program for the South.

During the winter of 1949-50 a field of oats on the farm of the State Industrial School at Florence, South Carolina was thought to have mosaic. On February 20, in company with T. W. Graham of this Bureau, the writer examined this field and found that it showed only the necrotic and chlorotic signs attending bacterial infection. Microscopic examinations made at the Pee Dee Station and by A. G. Johnson and Alice Robert at Beltsville, showed bacteria in abundance. The trouble was found to be a combination of stripe blight and halo blight. Practically no reddening was found in the diseased or in the healthy plants in this field.

On the same farm and near the above-mentioned oat field there was a field of wheat also showing an area of chlorotic plants associated with bacterial infection. The identity of the organism has not been determined. No chlorosis, other than that characteristic of bacterial infection, and no reddening attended this disease.

Anthocyanin Pigmentations. Anthocyanins are regarded as the common pigments of the cell sap that give the pink, red, and purple colorations to the foliage, sheaths, and stems of the small grains. However, the anthoxanthins and possibly the red plastid-pigment, lycopersicin, may be involved. These pigmentations are especially common in certain lines of oats in the southeastern area during the winter and early spring. Wheat and barley show these pigmentations to a less degree.

Anthocyanin expressions have been observed most frequently in association with cool and cold wet weather when the temperature has not been sufficiently low to disrupt the plastid system or kill much leaf tissue. In commercial fields or in increase plots, anthocyanin expression has often been evident in localized areas or spots as described above for the yellow plants. Sometimes a few reddish lower leaves appear on plants that show little stunting in their development, whereas in other cases the plants are stunted and have stiff upright leaves, all of which express the signs of the anthocyanins.

Occasionally, aphid colonies and moderate infestations of these insects have been observed. Reddening of the foliage, especially in certain varieties of oats, has been observed as one of the symptoms associated with these insects. This is a common observation in many areas and the disorder is not likely to cause much confusion in most cases.

Certain of the mosaic viruses accentuate anthocyanin pigmentations in oats as reported previously (4, 5), but this reddening is associated with the older leaves and with the signs of mosaic under proper environmental conditions. However, in the field, confusion can and does arise.

In the virus separation work done with the oat mosaic virus strains (4) there were no signs of a third strain that induces symptoms that might qualify as "red leaf" nor the red spot mosaic reported on oats by Rosen (7) in Arkansas. Observations by the writer in the southeastern area

as far south as Griffin, Georgia, have failed to reveal red spot mosaic.

Inoculations from red leaves from field and greenhouse grown oats have failed to show evidences of a virus cause, except when the signs of other known virus diseases were present or when infection by these viruses was suspected. Inoculations failed to show the presence of any wheat streak-mosaic virus in the so-called "red-leaf" or "new disease" of oats sent to the writer by C. S. Reddy and R. W. Leukel from Iowa in 1949.

Most of the anthocyanin type of pigmentation observed by the writer in the leaves of cereals seems to have followed abnormally low temperatures and/or excessive soil moisture conditions. In some cases the red to purplish pigmentations are confined to certain genetic lines of oats, and wheat grown in test nurseries. In other cases the colorations suggest that there may be mineral deficiencies or toxicity factors in the soil.

The interpretation of "hunger signs" frequently is difficult in field culture. Scarseth and Salter (1) point out that most of the intensive studies on nutrition have been made in greenhouses, in potted soil, in liquid nutrient solutions, and in sand- or gravel-solution cultures. It is indeed necessary to get much of the information in this manner, but as was pointed out by Hoffer (1) in the same treatise in his discussion of hunger signs in the cereals, "It is difficult at times to interpret the visual symptoms of nutrient deficiencies in the field because so many environmental factors constantly affect the plant."

Observations on Unusual Seasons

In the southern States, the winter grains rarely are dormant, even in mid-winter, and then only for very short periods. Plants are usually subjected to temperatures ranging from warm or even hot, to very cool or cold. During warm periods, there is high metabolic activity and much growth. With a sudden drop in temperature or during a prolonged cold period the metabolism of these plants receives a severe shock. Frequently this occurs during growth phases that normally should advance with a rising temperature. In areas having cold winters, these shocks are less frequent in both fall-sown and spring-sown grains.

In 1949-50, during autumn and winter to the end of the first week in February, the temperatures were unusually high, in fact near the highest, if not the highest on record at many locations. Observations during the third week of February (1950) in Virginia, the Carolinas, and Georgia revealed that up to that time there was an unusually small amount of yellowing and reddening in the small grains, as compared with previous seasons when the winter temperatures had averaged much lower.

In fields that had been sown at the normal time in moist soil, the plants were well established They had a healthy green color in a large majority of the fields observed, thus indicating that the plants had been functioning with an unusually satisfactory nutritional balance for an extended period. In a few areas in South Carolina and Georgia where unusually high fertility levels were being obtained, there was excessively succulent vegetation and much lodging, but chlorosis and anthocyanin development were of no consequence in plants that were free from the obvious parasitic diseases. In contrast with the situation in previous years, it appeared that many of the usual irregularities in soil nutrients and drainage were not reflected in the plants.

During the season of 1949, many of the spring oat areas in the Northern States experienced unusually cool to cold wet weather when spring grains should have been advancing with warm temperatures. Many aphids were reported during the period, and many of the oats developed pigment disturbances, especially reddening, suggestive of the situation often observed in the South, but during an earlier stage in the development of the plants.

Discussion

There is ample evidence that some parasites do induce pigment disorders in the foliage of the small grains when other conditions are right for expression. It is quite possible that one or more viruses induce some of the chlorotic disturbances and some of the anthocyanin pigmentations which are not now attributed to the known viruses. However, it seems to be reasonably evident that such a hypothetical virus or viruses will account for no more than a small fraction of the pigment disorders that have been observed over the years in the small grains of the South. It is too well recognized that many of these disorders can be induced by several non-parasitic factors, including adverse weather conditions, and deficiencies in the major and the trace elements, to give credence to the idea that plant parasites account for most of the pigment disorders in the small grains. Furthermore, it is well known that some genotypes in each of the small grains carry genetic factors for reddening, purpling and certain types of chlorosis that may or

may not be expressed, depending on the environment under which they are grown.

The writer's observations have indicated that direct cold injury to the leaves and nitrogen deficiency account for most of pigment disorders occurring in the southeastern areas. Frequently, low temperatures do not kill the leaves outright in certain varieties, but the plastids are affected, and the leaf tissue gradually becomes pale green. Such tissue may die, beginning at the tip of the leaf. Nitrogen deficiency occurs when long rainy periods prevent the application of commercial sources of this element or when prolonged rains carry away the soluble nitrogen that has been applied. Low temperatures retard nitrification and metabolic processes in general.

Observations indicate that by proper selection, the genotypes which frequently express the more extreme pigment disorders can be eliminated. It seems very questionable, however, if the genotypes showing the lesser degrees of pigment disorder on the marginal lands, and during the occasional season, should be discarded on account of these disorders alone. In wheat, oats and barley, as in other plants, genetic lines differ in their ability to produce chlorophyll. Lines developing the lesser amounts of chlorophyll make a bad appearance when the metabolic balance is affected by low temperature, lack of mineral elements, etc.

Some of the newer lines of oats, under certain environmental conditions, show an excessive amount of anthocyanin, and some express chlorosis, all of which tends to confuse the virus problems. In selecting away from these undesirable characteristics, the work must be done under conditions favoring their expression, and observations must continue throughout the cultural period of the crop.

It is clear that the whole problem of pigment disorder in cereals needs clarifying. These disorders have always been a source of confusion in the diagnosis of the virus diseases in the field, and sometimes in the greenhouse. A full understanding of the problem will depend on a more complete knowledge of genetic, ecologic, edaphic, enzymatic, and nutritional factors which regulate the metabolic functions relating especially to the plastid-pigment system, and to the sugars, glucosides, anthocyanins and anthoxanthins. The effects of adverse temperatures and soil moisture conditions on the pigment disorders need further study. Cool temperatures long have been known to induce and to accentuate the expression of anthocyanin pigmentations in certain genetic lines, but there is some indication that these pigmentations may be favored also by undue high temperatures and drought and excessive amounts of soil water. Light also influences their expression. With the present development of methods in spectrographic analysis, it should be possible to obtain much information on many of the chemical processes involved in the pigment disorders relatively quickly. These methods appear to be especially helpful in studies on the interrelated chemical processes in the plant, thus facilitating the physiological interpretations in plants from experiments designed for the genetic, edaphic, ecologic, nutritional and the parasitic phases of the pigment problem.

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DIVISION OF CEREAL CROPS AND DISEASES, U.S.D.A., BUREAU OF PLANT INDUSTRY, SOILS, AND AGRICULTURAL ENGINEERING

STEWART'S DISEASE PROSPECT FOR 1950

G. H. Boewe

In 1950, Stewart's disease, or bacterial wilt, of corn probably will occur much farther north and be much more destructive in Illinois than it was in the summer of 1949.

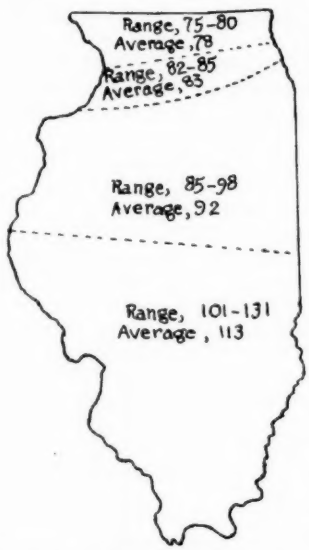

Figure 1. Winter temperature indices (see text) for Illinois, 1949-50.

Two principal types of damage to corn are produced by Stewart's disease: an early season wilt and death of the plant, especially in the sweet corn, and late season leaf blight which may be severe enough to cause death of plants, on both sweet corn and field corn. The wilt and leaf blight phases of the disease are expected to appear on susceptible varieties of corn in Illinois as shown by the table below.

Region	Early season wilt	Late season leafblight
Extreme north	None	None or trace
North	None	Light to moderate
Central	Light to severe	Moderate to severe
South	Destructive	Severe

The four regions listed in the table above are delineated on the map (Figure 1). These regions have been determined on the basis of winter temperature indexes (the sums of the mean temperatures of December, January, and February) calculated for 39 weather stations distributed throughout the state, from data obtained from the U. S. Weather Bureau at Springfield. The range of indexes and an average index are shown for each of the four regions. As indicating the future occurrence of Stewart's disease, these indexes appear to have significance as follows:

If the index is	Early season wilt probably will be	Late season leafblight probably will be
100 or more	Destructive	Severe
Between 90 and 100	Light to severe	Severe
Between 85 and 90	Absent or nearly so	Moderate to severe
Between 80 and 85	Absent or nearly so	Light to moderate
Below 80	Absent or nearly so	A trace, at the most

This forecast on Stewart's disease, the second to be made for Illinois, is based on the close relationship that appears to exist between the amount of disease which develops during the summer and the temperature of the preceding winter. In 1949, the development of both phases of the disease on sweet corn coincided very closely with the predictions made in the first forecast. Our observations indicate that the leaf blight phase of the disease in field corn also can be predicted on the basis of winter temperatures. In many corn fields leaf blight was severe to very destructive in the south half of the State and light to moderately severe in north central Illinois in 1949.

ILLINOIS STATE NATURAL HISTORY SURVEY, URBANA

REPORT ON A SEEDLING RICE DISEASE AT TIQUISATE, GUATEMALA C.A.

Albert S. Muller[1]

On January 30 and 31, 1950, month-old rice fields, with an area totalling some sixty acres, were inspected for the purpose of diagnosing the cause of the yellowed condition and poor growth of the seedlings. In addition to the high percentage of weakly plants in the fields, there was evidence of a greatly reduced stand, indicated by many small dead plants and spaces where plants had died in the early stages of growth.

On removing weak seedlings from the soil for examination, it was found that nearly all of them had a reduced root system because of infection and decay. Discolored brownish, red, infection spots were also observed girdling the stems at the ground level of most of the seedlings with root infection and of many seedlings with roots still sound.

For microscopic determination of the causal agent of this seedling blight, chambers were prepared in which infected seedlings were kept under moist conditions for several days. Separate sets of chambers held seedlings from three different fields, and samples of seed used for planting one of the fields. In addition a moist chamber was prepared containing specimens of rice heads with infected kernels, obtained from plants which had sprouted and grown after harvest in a neighboring field. These volunteer plants showed considerable leaf spotting of two different kinds, caused by fungus organisms, one of which was suspected of being of the same origin as the kernel and seedling infection.

Microscopic examination of the material under study revealed the presence of the rice disease fungus, Helminthosporium oryzae van Breda de Haan, on the root and stem lesions of the seedlings, and also sporulating on the spots on the seed samples germinating in the moist chambers. Helminthosporium oryzae was also found on the infected kernels and on the oval reddish-brown spots with ashen centers on the foliage of the volunteer plants, while Cercospora oryzae Miy. was found on the narrow reddish elongated spots on the leaves of the same plants. About 90 percent of the seed was spotted, mostly by Helminthosporium.

In literature on rice diseases, the fungus Helminthosporium oryzae is cited as the cause of rice failure due to seedling blight in many countries. A sample of rice seed from Guatemala, tested in the laboratory of the Interamerican Institute of Agricultural Sciences, Turrialba, Costa Rica, C.A., in 1949 showed 50 percent infection by Helminthosporium oryzae! Seed treatment was made of 1,500 quintales in Costa Rica in 1949 against this disease.

Conditions were especially favorable for foliage and seed infection in the period just before harvest in Guatemala in 1949, when even inundations of rice fields followed a prolonged rainy period and caused the total loss of some fields. There is no doubt that the seed used in the present plantings was heavily infected and that the application of an inch of overhead irrigation water weekly favored the development of the disease, especially in the depression spots of the fields where the water puddled the soil for several days after application. Many plants will outgrow the infection, however.

It was recommended to irrigate every two weeks, instead of weekly. A test of the effect of a nitrogen application to invigorate the weakened plants was advised. Since the disease is very prevalent in the area at present, it is recommended that future plantings be made with disinfected seed only. Fields used for rice in 1949 should not be planted again to rice in the coming season. It should be possible to obtain seed from regions where the disease is not prevalent.

ESCUELA NACIONAL DE AGRICULTURA, FINCA "BARCENA" - VILLA NUEVA, GUATEMALA, C.A.

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BRIEF NOTES ON PLANT DISEASES

APPLE SCAB ASCOSPORES ABNORMALLY EARLY IN MASSACHUSETTS

By O. C. Boyd

Nearly every leaf sample received from the counties so far this spring show ascospore development to be much farther advanced than fruit bud development. In fact, spores are "ready to go" in some leaves where the buds are merely swelled a bit - to silver tips. The unusually mild weather in December and January with no snow cover, followed by some additional damp, mild weather during the past two weeks, no doubt contributed to early spore maturity.

UNIVERSITY OF MASSACHUSETTS, AMHERST. April 10, 1950

HELMINTHOSPORIUM ON KENTUCKY 31 FESCUE IN LOUISIANA

By J. G. Atkins

In mid-January a field of Kentucky 31 fescue near Baton Rouge, Louisiana, was examined upon request of the Soil Conservation Service. The fescue had been planted during the fall months. Although the fescue showed good growth, a high percentage of the leaves or blades showed dark indefinite spots or net-like blotches with yellowish or dead tips. Many leaves, particularly, the lower leaves, were dead. On the basis of symptoms and conidia found on necrotic tissue the disease was tentatively identified as being caused by Helminthosporium dictyoides Drechs.

By mid-February following grazing the disease appeared to be less severe. Specimens received from other locations in Louisiana indicate that the disease is widespread on fescue. Observations indicate that this Helminthosporium may cause considerable damage on Kentucky 31 fescue under certain conditions in southern Louisiana.

DEPARTMENT OF PLANT PATHOLOGY, LOUISIANA AGRICULTURAL EXPERIMENT STATION, BATON ROUGE, LOUISIANA

OCCURRENCE OF NIGROSPORA ORYZAE (B. and Br.) PETCH IN VENEZUELA, WITH A NOTE ON DISCHARGE OF SPORES

By J. H. Standen

About ten years ago the author published a short note in this journal on the prevalence of Nigrospora oryzae in poorly developed secondary ears and arrested axillary shoots of maize. Observations in several parts of United States have shown that the fungus is generally prevalent in these structures. In the last two years the author has had opportunity to examine the same tissues in several parts of Venezuela. Although ear infection has been observed several times, examination of hundreds of arrested axillary shoots has failed to reveal a single infection by this fungus. Poorly developed secondary ears likewise are not commonly subject to attack as in several parts of United States.

While examining cobs infected with Nigrospora here in Venezuela it was observed that the spores were being discharged. As those who are familiar with the fungus know, the spores are borne singly on inflated sporophores. The use of such inflated structures to discharge spores or spore masses is well known in certain other fungi. Because of lack of time when discharge was first observed, the author was only able to arrange one coated slide above the specimen, at a distance of 3 mm. In 20 minutes the slide was well peppered with spores. A couple weeks later discharge was again observed. A series of slides were arranged at distances of from 3 to 20 mm. The slides at less than 20 mm. above the specimens were well sprinkled with spores. At 20 mm. three spores were found on the slide.

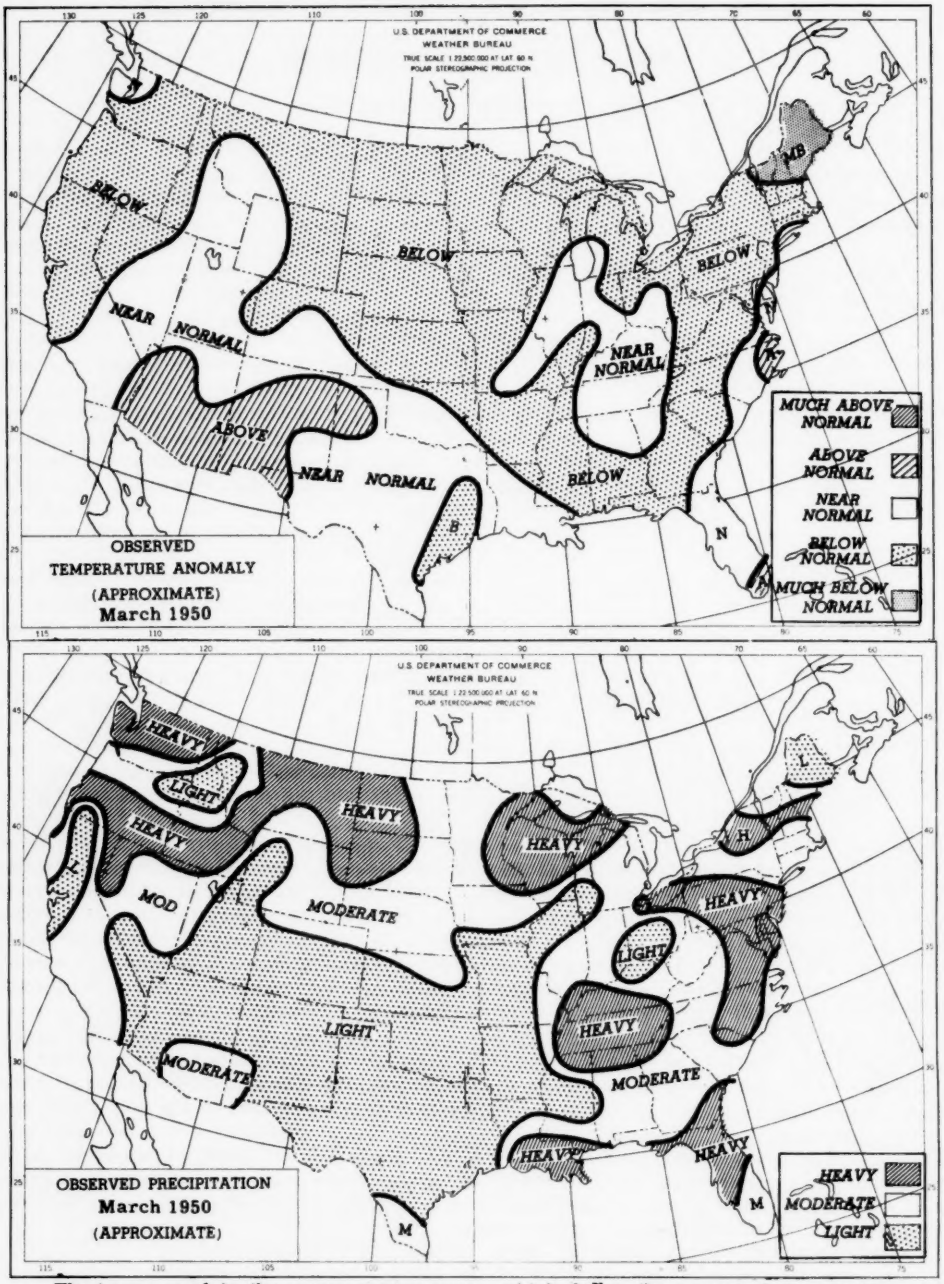
DIVISION DE FITOPATOLOGIA, M.A.C., MARACAY, VENEZUELA

OCCURRENCE OF OVULARA CANAEGRICOLA P. HENN. ON CANAIGRE (RUMEX HYMENOSEPALUS TORR.)

By. L. M. Pultz

We have a report from our field man in Arizona that a leaf spot disease identified by Dr. J. G. Brown, University of Arizona, as Ovularia canaegricola P. Henn. caused serious damage to a part of our experimental plantings of canaigre located at Chandler Heights, Arizona. Subsequently the plants seemed to outgrow the disease and put out new growth but we are still watching the spread of the disease because of the possible effect of the leaf spot on root production in the plants.

DIVISION OF TOBACCO, MEDICINAL, AND SPECIAL CROPS. April 12, 1950



The terms used in the accompanying maps, which define the ranges of temperature and precipitation, are numerical class limits. These are based on a statistical analysis of past records through which is determined the normal frequency of occurrence of temperatures and precipitation at various times of the year for different locations. For temperature the classes above, below, and near normal are so defined that they each normally occur one-fourth of the time; much above and much below normal, one-eighth of the time. Precipitation is depicted in terms of light, moderate, and heavy, each class normally occurring one-third of the time and thereby having equal probability of occurrence. These maps graphically represent only the general trends and give the country's weather picture at a glance. For quantitative studies, where monthly mean temperatures and actual precipitation records are needed for a given time and place, other publications of the Weather Bureau should be consulted. P.R.M.